VANTAGE® Ultra

User Manual

EAZ0081L00B Rev. B

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IMPORTANT:

Before operating or maintaining this unit, please read this manual carefully paying extra attention to the safety warnings and precautions.

Contact Information (North America)

Websites:

Snap-on Diagnostics and Information

- http://diagnostics.snapon.com

Software Subscription - Learn how to always have the latest diagnostic software on your diagnostic tool.

- http://diagnostics.snapon.com/theprogram

ShopStream Connect - Download free PC-based companion software used to transfer, save, manage, review, annotate, e-mail and print files saved or recorded on your Snap-on diagnostic tool.

- http://diagnostics.snapon.com/ssc

Training and Forums - Watch free instructional product videos and connect with and share your diagnostic tool questions, ideas and success stories.

- http://diagnostics.snapon.com/ForumsandTraining.htm

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- http://diagnostics.snapon.com/usermanuals

Customer Care and Technical Assistance - Phone / E- mail

1-800-424-7226 / diagnostics_support@snapon.com

For technical assistance in all other markets, contact your selling agent

Safety Information

READ ALL INSTRUCTIONS

For your own safety, the safety of others, and to prevent damage to the product and vehicles upon which it is used, it is important that all instructions and safety messages in this manual and the accompanying *Important Safety Instructions* manual be read and understood by all persons operating, or coming into contact with the product, before operating. We suggest you store a copy of each manual near the product in sight of the operator.

For your safety, read all instructions. Use your diagnostic tools only as described in the tool user's manual. Use only manufacturer recommended parts and accessories with your diagnostic tools.

This product is intended for use by properly trained and skilled professional automotive technicians. The safety messages presented throughout this manual and the accompanying *Important Safety Instructions* manual are reminders to the operator to exercise extreme care when using this product.

There are many variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. Because of the vast number of test applications and variations in the products that can be tested with this instrument, we cannot possibly anticipate or provide advice or safety messages to cover every situation. It is the responsibility of the automotive technician to be knowledgeable of the system being tested. It is essential to use proper service methods and test procedures. It is important to perform tests in an appropriate and acceptable manner that does not endanger your safety, the safety of others in the work area, the equipment being used, or the vehicle being tested.

It is assumed that the operator has a thorough understanding of vehicle systems before using this product. Understanding of these system principles and operating theories is necessary for competent, safe and accurate use of this instrument.

Before using the equipment, always refer to and follow the safety messages and applicable test procedures provided by the manufacturer of the vehicle or equipment being tested. Use the product only as described in it's user manual. Use only manufacturer recommended parts and accessories with your product.

Read, understand and follow all safety messages and instructions in this manual, the accompanying *Important Safety Instructions* manual, and on the test equipment.

Environmental Conditions:

- This product is intended for indoor use only
- This product is rated for Pollution Degree 2 (normal conditions)

Safety Signal Words

All safety messages contain a safety signal word that indicates the level of the hazard. An icon, when present, gives a graphical description of the hazard. Safety Signal words are.

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury to the operator or to bystanders.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to the operator or to bystanders.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury to the operator or to bystanders.

Safety Message Conventions

Safety messages are provided to help prevent personal injury and equipment damage. Safety messages communicate the hazard, hazard avoidance and possible consequences using three different type styles:

- Normal type states the hazard.
- **Bold type states how to avoid the hazard.**
- *Italic type states the possible consequences of not avoiding the hazard.*

An icon, when present, gives a graphical description of the potential hazard.

Safety Message Example

⚠ WARNING

Risk of unexpected vehicle movement.

- **Block drive wheels before performing a test with engine running.**

A moving vehicle can cause injury.

Important Safety Instructions

For a complete list of safety messages, refer to the accompanying *Important Safety Instructions manual*.

SAVE THESE INSTRUCTIONS

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Chapter 1 Using This Manual

1.1 Content

This manual contains basic operating instructions and is structured in a manner to help you become familiar with your Diagnostic Tool features and perform basic operations.

The illustrations in this manual are intended as reference only and may not depict actual screen results, information, functions or standard equipment. Contact your sales representative for availability of other functions and optional equipment.

1.2 Conventions

The following conventions are used.

1.2.1 Terminology

The term “select” describes tapping/touching an icon on the touch screen, or highlighting an icon or menu choice and then selecting the confirmation menu choice such as **Continue, Accept**, **OK**, **Yes, or other similar** choice.

Abbreviated example for the following procedure: “Select **Brightness**”

1. Navigate to and highlight the **Brightness** selection.
2. Select **OK, or similar,** button.

1.2.2 Symbols

Different types of arrows are used. The “greater than” arrow (**>**) indicates an abbreviated set of selection (navigation) instructions.

Abbreviated example for the following procedure: “Select **Tools > Connect-to-PC**”

1. Select **Tools** from the home screen.
2. Highlight **Connect-to-PC** on the Tools menu.
3. Select **Connect-to-PC**.

The solid arrows (◄, ►, ▼, ▲) are navigational instructions for the four directions of the directional buttons.

Example: Press the down ▼ arrow.

1.2.3 Bold Text

Bold emphasis is used in procedures to highlight selectable items such as control buttons, icons and menu options.

Example: Press the **OK** button

1.2.4 Notes and Important Messages

The following messages are used.

Notes

A NOTE provides helpful information such as additional explanations, tips, and comments.

Example:

NOTE:
For additional information refer to...

Important

IMPORTANT indicates a situation which, if not avoided, may result in damage to the test equipment or vehicle.

Example:

IMPORTANT:
Do not use any abrasive cleaners or chemicals on the touch screen.

1.2.5 Hyperlinks

Hyperlinks, or hot links, that take you to other related articles, procedures, and illustrations are available in electronic documents. Blue colored text indicates a selectable hyperlink.

Example:

IMPORTANT:
Read all applicable Safety Information before using this Diagnostic Tool!

1.2.6 Procedures

An arrow icon in the left-margin area indicates a procedure.

Example:

To change screen views:

1. Select the **Graph** icon.
   The dropdown menu displays.
2. Select an option from the menu.
   The screen layout changes to the format selected.

Chapter 2 Introduction

The Vantage® Ultra is a multi-function two-channel lab scope, graphing multimeter, and the exclusive Snap-on Guided Component Test database combined into a single hand-held Diagnostic Tool.

This chapter introduces the basic features of the Diagnostic Tool, including the control buttons, meter connections, battery pack, and power sources. Technical Specifications are provided at the end of this chapter.

2.1 Control Buttons

There are four “push type” control buttons and one “thumb pad rocker type” multi-directional button located on the right side of the Diagnostic Tool. All other Diagnostic Tool operations are controlled through the touch screen.

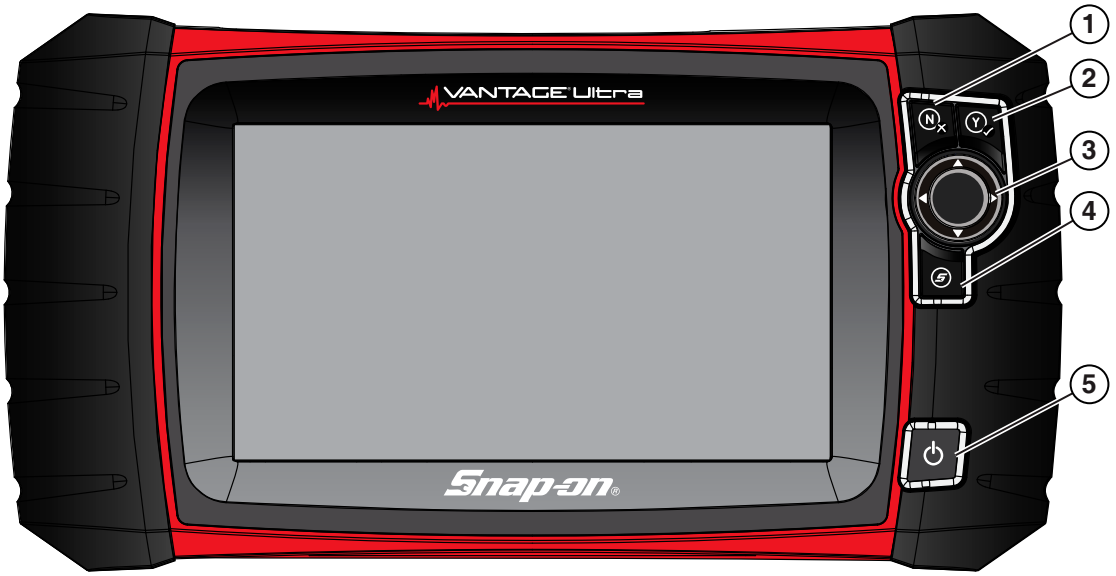
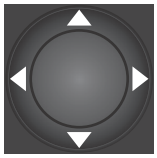


Figure 2-1 *Front view*

Item	Button	Description	
1		**N/X or Cancel** - Push type button	• To exit a menu or program. • To close an open list and return to the previous menu or screen. • To answer “No” when a yes/no choice is given.
2		**Y/✓ or Accept** - Push type button	• To confirm a selection from a menu or program • To select an item that was highlighted using the direction arrows. • To advance to the next screen in a series. • To answer “Yes” when a yes or no choice is given.

Item	Button	Description	
3		**Directional** - Thumb pad rocker type buttons	Buttons move the cursor or highlight in their respective direction: • Up (▲) • Down (▼) • Left (◀) • Right (▶)
4		**(Shortcut)** - Push type button	Programmable function button that can provide a shortcut for performing a variety of routine tasks. Refer to Configure Shortcut Button, on page 47 for additional information.
5		**Power (On/Off)** - Push type button	Turns the Diagnostic Tool on and off. Also, press and hold for 5 seconds for emergency shutdown

2.2 Data and Power Connections

Connectors and jacks for the scope multimeter, and the AC/DC power supply are located on the top of the Diagnostic Tool.

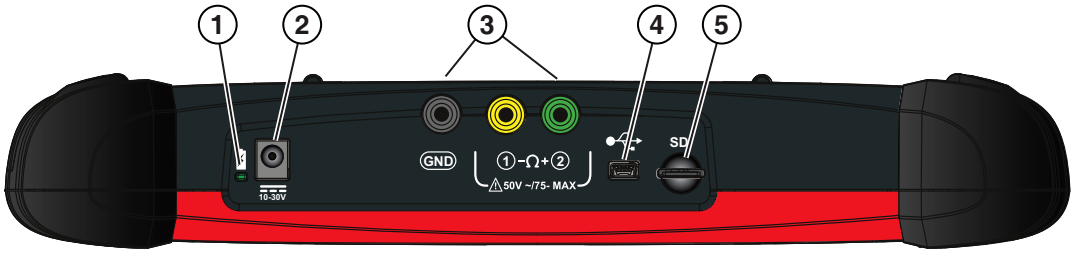


Figure 2-2 *Top view*

Item	Description
1	**Battery Status Indicator LED** • Green - battery is fully charged • Red - battery is charging • Amber - indicates there is a battery issue (correct before operating)
2	**DC Power Supply Jack** - AC/DC power supply connection
3	**Scope/Multimeter Jacks** - Scope and multimeter lead connections
4	**Mini USB Jack** - USB cable connection used to connect the Diagnostic Tool to a personal computer
5	**Micro secure digital (uSD) Card** - contains operating system programming. ***IMPORTANT The uSD card must be installed for the Diagnostic Tool to operate. Do not remove the uSD card while the Diagnostic Tool is powered on.***

2.3 Battery Pack and Stand

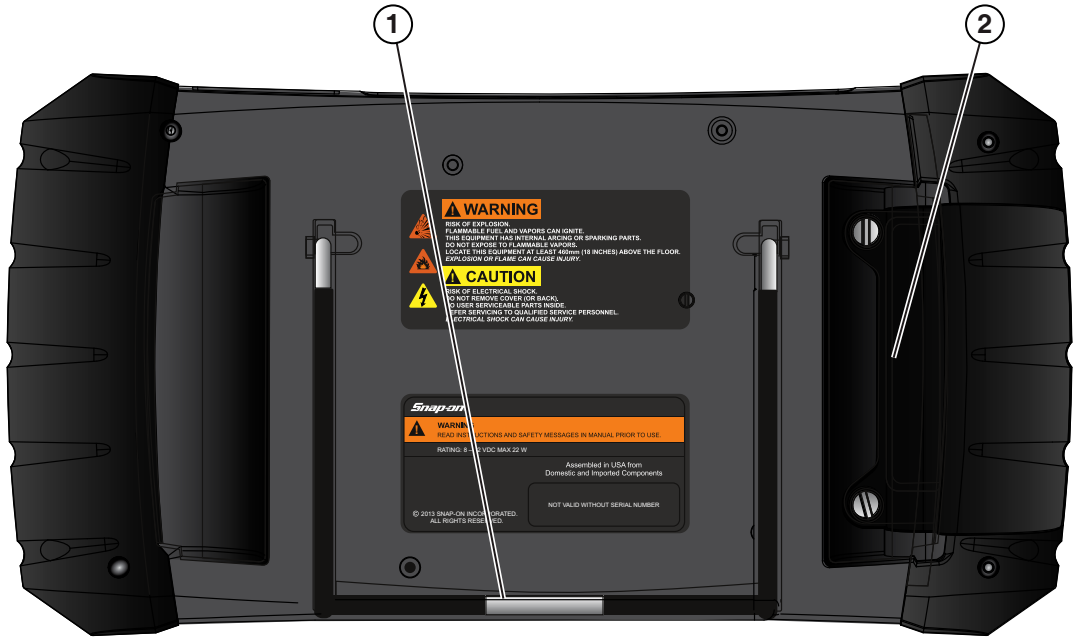


Figure 2-3 *Back view*

Item	Description
1	**Built in-Stand (shown closed)** - The built-in stand extends from the back of the Diagnostic Tool and clips into the Diagnostic Tool for storage.
2	**Battery Cover** - connection for AC/DC power supply jack

2.4 Power Sources

Your Diagnostic Tool can receive power from any of the following sources:

- Internal Battery Pack
- AC/DC Power Supply

2.4.1 Internal Battery Pack

The Diagnostic Tool can be powered from the internal rechargeable battery pack. A fully charged battery provides sufficient power for about 3 hours of continuous operation.

Battery charging occurs when the Diagnostic Tool is connected to the AC/DC Power Supply and to a live AC power source.

The Battery Status Indicator LED (located next to the DC power supply jack) indicates battery status (Figure 2-3).

- **Green** - indicates battery is fully charged
- **Red** - indicates battery is charging
- **Amber** - indicates a battery issue. This is usually caused by excessive battery temperature (above 104°F/40°C), which disables charging. Allow the Diagnostic Tool to cool down be continuing operation.

2.4.2 AC/DC Power Supply

The Diagnostic Tool can be powered from a standard AC outlet using the AC/DC power supply. The connector on the end of the output cable of the AC/DC power supply attaches to the DC power supply input jack on top of the Diagnostic Tool. Use only the AC/DC power supply provided.

2.5 Technical Specifications

Item	Description / Specification
Touch Screen	Resistive Touch Panel
Display	8.0 inch diagonal, Color LCD
	800 x 480 resolution SWVGA
Meter	Category 1
Battery	Rechargeable lithium-ion battery pack
	Approximately 3 hour run time
	Approximately 5 hour charge time
Power Supply	Supply Rating; 15 VDC, 2A
DC Operating Voltage	10 to 30VDC
Width	12.9 in. (327.2 mm)
Height	6.5 in. (165 mm)
Depth	2.04 in. (51.8 mm)
Weight (including battery):	3.25 lb (1.47 kg)
Operating Temperature Range (ambient)	At 0 to 90% relative humidity (non-condensing) 32 to 113°F (0 to 45°C)
Storage Temperature (ambient)	At 0 to 70% relative humidity (non-condensing) –4 to 140°F (–20 to 60°C)
Environmental Conditions	This product is intended for indoor use only
	This product is rated for Pollution Degree 2 (normal conditions)

Chapter 3 Basic Operation and Navigation

This chapter describes basic Diagnostic Tool operation, navigation, screen layout, icon functions, and screen messages. Before you operate the Diagnostic Tool, make sure the battery pack is fully charged or the Diagnostic Tool is powered by the AC power supply.

3.1 Turning On/Off and Emergency Shutdown

The following sections describe how to turn the Diagnostic Tool on and off and how to perform an emergency shutdown.

3.1.1 Turning On

The Diagnostic Tool will automatically turn on and open the Home screen (Figure 3-1) when power is supplied by the AC/DC Power Supply. If the Diagnostic Tool does not automatically turn on, press and release the Power button on the front of the Diagnostic Tool to turn the Diagnostic Tool on.

3.1.2 Turning Off

IMPORTANT:
All vehicle communication must be terminated **BEFORE** turning off the Diagnostic Tool. A warning message displays if you attempt to turn the Diagnostic Tool off while communicating with the vehicle. Forcing a shut down while communicating may lead to ECM problems on some vehicles. Never disconnect the Data Cable when the Diagnostic Tool is communicating with the vehicle ECM.

To turn off the Diagnostic Tool:

1. Close and exit all applications normally and navigate to the Home screen.
   A “stopping communication” message may appear briefly before the Home screen displays.
2. Disconnect the Diagnostic Tool Data Cable from the vehicle.
3. Press and release the **Power** button.
   A confirmation screen displays.
4. Press the **Y/✓** button or select **OK** from the menu to turn the Diagnostic tool off. To continue operating, press the **N/X** button or select **Cancel** from the menu.

3.1.3 Emergency Shutdown

IMPORTANT:
Using the emergency shutdown procedure while communicating with the vehicle ECM may lead to ECM problems on some vehicles.

During normal operation turn the Diagnostic Tool off using the *Turning Off* procedure above. The emergency shutdown procedure should only be used If the Diagnostic Tool does not respond to navigation or control buttons or exhibits erratic operation. To force an emergency shutdown, press and hold the **Power** button for five seconds until the Diagnostic Tool turns off.

3.2 Basic Navigation

3.2.1 Home Screen Layout

The Home screen includes a title bar and main body. The Home screen contains icons, one for each of the primary Diagnostic Tool functions.

1— Title Bar
2— Main Body

Figure 3-1 *Home screen*

3.2.2 Title Bar

The title bar at the top of the screen provides basic information about current Diagnostic Tool operating conditions. Title bar options vary depending upon vehicle make and model, what function is active, what test is being performed, or what menu is selected. The title bar contains information only, there are no selectable items.

Elements of the Title bar let you know at a glance:

- What Diagnostic Tool function is currently active.
- The current time.
- The source and status of the power being supplied to the Diagnostic Tool.

An active function icon is always displayed along the left-hand edge of the Title bar. These icons resemble their Home screen icon counterparts in appearance and color. The name of the function displays to the right of the icon on some screens.

A real time clock displays to the left of the power supply icon. The clock is powered by a dedicated internal battery, so the correct time is maintained even when the main battery pack is discharged. Use the Tools function to set the clock and format how time is displayed. See Clock Settings, on page 53 for additional information.

The Title bar displays other information that varies depending upon what functions are being performed. Other information may include:

- The identification (ID) of the test vehicle
- The name of the active menu or function
- The name of the test being performed

Table 3-1 *Title Bar Icons*

Icon	Function
	Full Battery Charge Level - Indicates power is being supplied by the internal battery pack. Horizontal bars diminish as the battery discharges.
	Low Battery Charge Level - Indicates the internal battery pack is low and needs to be recharged immediately. A warning message will also display on the screen when the battery gets low.
	External Power Connected - Indicates power is being supplied by the AC/DC Power Supply.

3.2.3 Home Screen Icons

Each available Diagnostic Tool function is represented by a icon on the home screen. The table below provides descriptions of the icon functions.

Select an icon from the Home screen to start a function. You can also use the control buttons to activate a function, a yellow border around the icon indicates it is highlighted, or in focus. Use the Directional buttons (◄, ►, ▲, ▼) to highlight the desired function and then press the **Y/✓** button to select it. A “please wait” message may display briefly, then automatically clear once the function is loaded and ready for use.

Table 3-2 *Home screen icons*

Function Name	Function Icon	Description
Guided Component Tests		Allows you to perform diagnostic tests for the identified vehicle. See Guided Component Tests, on page 14.
Scope Multimeter		Allows you to perform lab scope, graphing multimeter and digital multimeter tests and measurements. See Scope Multimeter, on page 22.
Previous Vehicle & Data		Allows you to quickly reconfigure the Diagnostic Tool to a recently tested vehicle and to access saved data files.See Previous Vehicles and Data, on page 43 for details.
Tools		Allows you to adjust Diagnostic Tool settings to your personal preferences and perform other special functions. See Tools, on page 46 for details.

3.2.4 Common Toolbar Control Icons

Common control icon functions are described in the following table. Specific function control icons are described in their applicable chapters. Displayed control icons vary depending on the active function or test. Select a control icon on a screen to activate a control function. You can also use the control buttons to activate a function, a yellow border around the icon indicates it is highlighted, or in focus. Use the Directional buttons (◄, ►, ▲, ▼) to highlight the desired function and then press the **Y/✓** button to select it.

Icon	Function	Icon	Function
	Back - Returns to the previously viewed screen. Icon is located on the left-hand edge of the toolbar.		**Record** - Indicates the data being displayed is paused and not being updated. Selecting resumes data collection.
	Home - Returns to the Home screen. Icon is located next to the Back icon on the left side of the toolbar.		**Tools** - Opens the tools menu.
	Save - Writes data from buffer memory to a file. The saved "movie" file can be accessed for future reference by selecting **Previous Vehicles and Data > View Saved Data**.		
The control icons below are used to navigate through paused or saved "movie" files during playback.			
	Step Forward - allows forward movement in singular steps. To quickly step forward, select this icon (yellow frame appears) then press and hold the Y/✓ button. (**Note:** To quickly step forward during data playback, press and hold the icon down until a red frame appears around the icon.)		**Step Back** - allows backward movement in singular steps. To quickly step backward, select this icon (yellow frame appears) then press and hold the Y/✓ button. (**Note:** To quickly step backward during data playback, press and hold the icon down until a red frame appears around the icon.)
	Skip Forward - allows forward movement in multiple steps. To quickly skip forward, select this icon (yellow frame appears around icon) then press and hold the Y/✓ button		**Skip Back** - allows backward movement in multiple steps. To quickly skip backward, select this icon (yellow frame appears around icon) then press and hold the Y/✓ button.

3.2.5 Scroll Bar

A vertical scroll bar appears along the right-hand edge of the screen when additional data expands above or below what is currently on the screen (Figure 3-2).

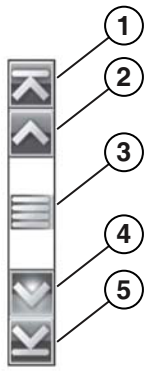


Figure 3-2 *Scroll bar*

1— Beginning - Moves to beginning of data displayed
2— Step up - Moves up one increment of the data displayed
3— Slider (position indicator) - Select and drag the **Slider** to scroll through data. The slider indicates the relative position of the current screen to the total available data.
4— Step down - Moves down one increment of the data displayed
5— End - Moves to end of data displayed

The Up (▲) and Down (▼) directional buttons can also be used to move through the data one line at a time. Press and hold a directional button to rapidly scroll through data.

3.3 Screen Messages

3.3.1 System Messages

There are four types of system messages that may be displayed:

Message Type	Description
Loading and Connecting	Loading and connecting messages display when the Diagnostic Tool is performing an internal operation, such as loading a database, or initiating a test. The message automatically clears once the internal operation is complete.
Confirmation	Confirmation messages inform you when you are about to perform an action that cannot be reversed or when an action has been initiated that requires a confirmation to continue.When a response is not required, the message displays briefly, then disappears.
Warning	Warning messages inform you when completing the selected action may result in an irreversible change or in the loss of data. A confirmation is required to continue
Error	Error messages inform you when a system or procedural error has occurred.

Chapter 4 Guided Component Tests

Guided Component Tests provides you with a robust diagnostic database for use with scopes and meters. It is like having access to a complete library of shop manuals for testing engine management, transmission control, and ABS components.

Guided Component Tests helps you with everything from selecting the appropriate test for a specific part to pointing out the best location to hook-up the test leads and the pin configuration of the connector.

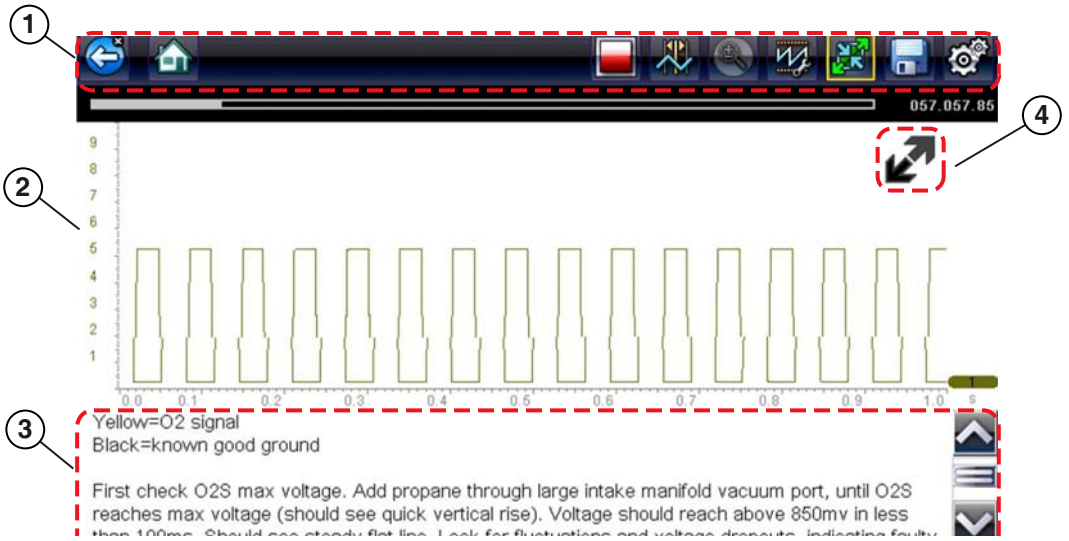
The component test procedures, tips, and meter settings reduce your overall set-up and diagnostic testing time. Vehicle-specific component tests are provided for engine, transmission, ABS, charging, transfer case and suspension systems. Availability varies by vehicle.

4.1 Screen Layout and Toolbar Icons

This section describes general navigation of the Guided Component Tests screen layout and toolbar icons.

Guided Component Test data is vehicle specific. The displayed meter is configured to perform the selected test on the identified vehicle. Also provided are test results, procedures, tips, and specifications for the selected test.

4.1.1 Screen Layout


1
2
3
4
057.057.85
Yellow=O2 signal
Black=known good ground
First check O2S max voltage. Add propane through large intake manifold vacuum port, until O2S reaches max voltage (should see quick vertical rise). Voltage should reach above 850mv in less

1— Toolbar—contains control icons

2— Main Body—displays menus, information and test graph/meter display

3— Information Panel—displays test information

4— Expand/Collapse icon—toggles Main body view between full graph/meter and split information panel views

Figure 4-1 *Test screen*

Main Body

The main body of a Guided Component Test screen may display any of the following:

- A selectable menu - Select from a menu using the touch screen or the control buttons.
- Component information - Component information screens contain information to assist you with testing.
- A Diagnostic Tool - Diagnostic Tools can display two circuit traces, or waveforms, simultaneously. Adjustments to the display are made through the toolbar. Each trace is displayed as voltage over time on a standard oscilloscope screen. Voltage level is recorded on the vertical, or “y”, axis and time is presented on the horizontal, or “x”, axis of the screen. Values are shown for each graduation on the scales

Touch screen functionality within the main body of the screen is limited. Most adjustments are performed from the Toolbar and the Profile window, however you can adjust the baseline position (0 value) of the trace on the horizontal scale by touching and dragging the solid bar of the channel baseline indicator.

4.1.2 Guided Component Tests Control Icons

Guided Component Tests toolbar control icons may vary depending on the active function or test. A yellow frame surrounding an icon (highlighted), indicates it is selected. Other control icons (not shown) are described in Common Toolbar Control Icons, on page 12.

Table 4-1

Icon	Function
	Stop - Stops the collection of data
	Cursors - Toggles cursor display on/off. Cursors are two vertical rules that can be repositioned on the screen to measure intervals.
	Zoom - Increases and decreases screen magnification.
	Profile - Displays the profile settings at the bottom of the screen allowing adjustment of the trace signal display settings.
	Expand/Collapse - Toggles the Main body display between full information, full graph/meter, and split screen

4.1.3 Extras Menu (Top Level Menu Items)

The Extras icon, also known as the Top Level Menu items, are only available on the Guided Component Tests home screen. The Extras icon opens a menu containing three selections designed to help you get the most out of the Guided Component Tests module.

- Power User Tests
- How To Guide
- Features and Benefits

Figure 4-2 *Extras Icon (Top Level Menu Items)*

Power User Tests

The **Power User Tests** option gives you quick access to a preconfigured meter for conducting a number of control system tests. Tests are available with or without on-screen help. Help typically provides a description of the test along with expected results and a link to the pre-set meter.

How To Guide

The **How To** option provides a list of available on-screen instructions for performing tasks. Scroll to view the entire list. Topics include:

- **10-MINUTE ELECTRONIC CLASS**—provides basic electronics and circuit instructions.
- **15-MINUTE IGNITION CLASS**—provides an introduction to basic ignition testing.
- **ILLUSTRATED TERMS & DEFINITIONS**—provides definitions of terms, drawings and tips associated with component testing.
- **NO-START BASICS**—provides a guideline for diagnosing a no-start condition.
- **O2 SENSOR & FEEDBACK SYSTEM ANALYSIS**—displays a “live” graphing component Diagnostic Tool with tips explaining the fundamental concepts of O2 sensor diagnostics.
- **TEST TIPS**—gives instructions for performing specific tests along with drawings and tips.
- **20-MINUTE CURRENT RAMP CLASSES**—provides an introduction to current ramp testing.

Features and Benefits

Selecting **Features and Benefits** opens a menu page that includes:

- **5-MINUTE WALK THRU WITH DEMO BOARD**—explains how to use the optional demonstration board to generate sample signals and sharpen your skills.
- **Features & Benefits**—provides descriptions and a brief overview of meter functions.
- **Accessories**—opens a menu of available optional equipment.
- **Product description**—provides descriptions and a brief overview of meter operations.

The optional demonstration board transmits a number of adjustable electronic signals similar to what is commonly found on modern vehicles. The demonstration board not only helps you learn how to use the Guided Component Tests software, it allows you to hone your skills and diagnostic techniques without an actual test vehicle. Contact your sales representative for details.

4.2 Guided Component Tests Operation

4.2.1 Vehicle Identification

The information presented is specific to the vehicle being tested. Therefore, certain attributes of the test vehicle must be entered into the Diagnostic Tool so that the correct data can be retrieved. Vehicle identification information is carried over if you enter the Guided Component Tests from one of the records stored in Vehicle History. However, you may need to enter additional attributes in some instances.

The vehicle identification sequence is menu driven, follow the screen prompts to enter the information. Exact procedures may vary by the make, model, and year of the vehicle.

To identify a vehicle for testing:

1. Select the **Guided Component Tests** icon on the Home screen.
2. Select a vehicle type from the menu.
   A list of manufacturers displays (Figure 4-3).

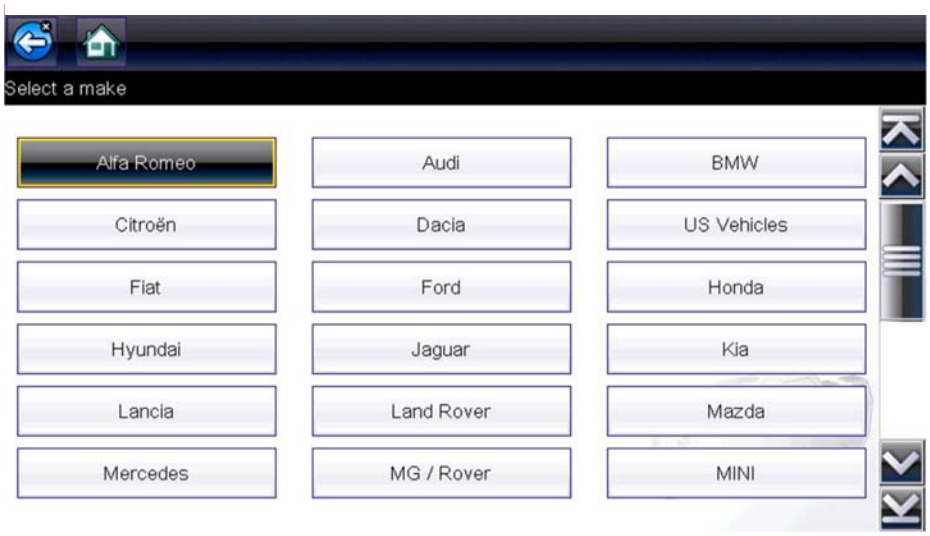


Figure 4-3 *Manufacturer list*

3. Select the vehicle manufacturer from the list.
   A model year menu displays.
4. Select the vehicle year from the menu.
   A list of vehicle models displays. Several selections may be required to complete the vehicle identification, follow the screen prompts to enter the required information.

A confirmation screen displays once all the required information has been entered (Figure 4-4).

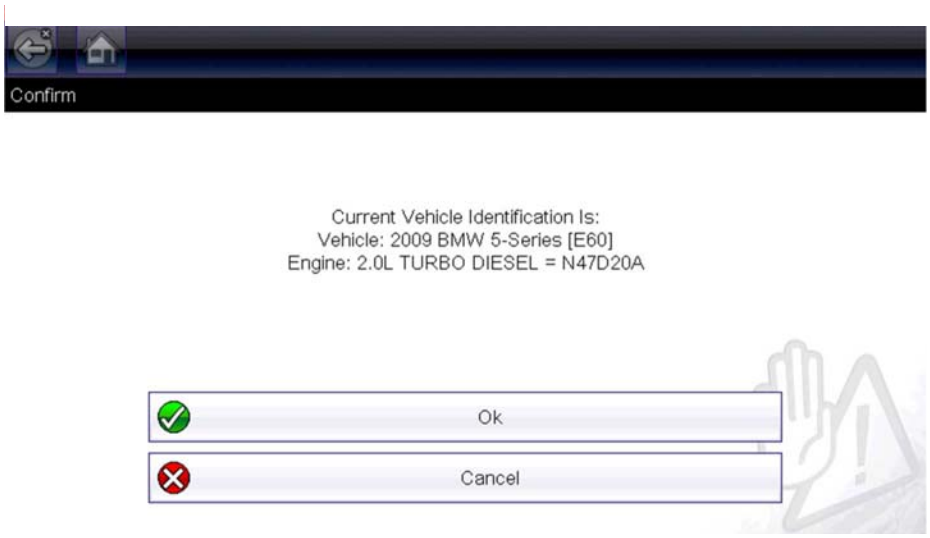


Figure 4-4 *Vehicle confirmation screen*

5. From the Confirm Vehicle screen select:
   a. **OK** to continue.
   b. **Cancel** to return to the previous screen.

   A list of systems available for testing displays (Figure 4-5).

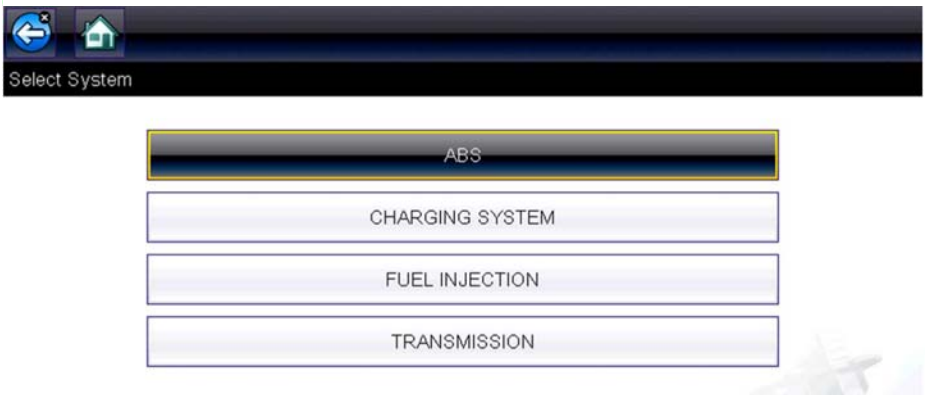


Figure 4-5 *Available systems menu*

6. Select a system and a list of tests available for the identified vehicle displays
7. Select a test from the list to continue.

   The identification sequence is now complete, refer to the Operations section that follows for details on how to navigate through the Guided Component Tests information and perform tests.

4.2.2 Component Testing

The Guided Component Tests software provides vehicle specific component test procedures and information that aid in setting up scopes and meters. Once a test vehicle is identified, you can select a component test from the list of available tests. A Guided Component Tests menu displays once a component is selected, two types of information are available on the menu:

1. **COMPONENT INFORMATION**—provides information on the selected component and connector pin details that assists you in understanding the components prior to diagnosis.
2. **TESTS**—opens a preconfigured meter for performing the selected test, instructions for performing the test, and offers tips and resources to reduce setup and testing time.

4.2.3 Component Information

Use the Component Information to get details on component operation.

To view component information:

1. Select a component from the tests list.
2. Select **COMPONENT INFORMATION** from the component menu.

NOTE:
An additional selection, such as front or rear for an oxygen sensor (O2S), may be required before advancing to the component information screen.

Component information displays in the main body of the screen (Figure 4-6).

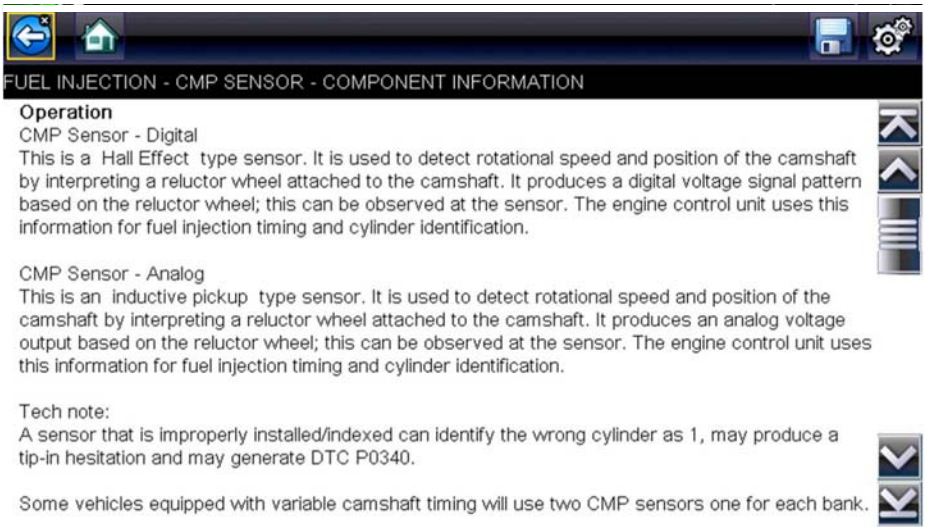

FUEL INJECTION - CMP SENSOR - COMPONENT INFORMATION
Operation
CMP Sensor - Digital
This is a Hall Effect type sensor. It is used to detect rotational speed and position of the camshaft by interpreting a reluctor wheel attached to the camshaft. It produces a digital voltage signal pattern based on the reluctor wheel; this can be observed at the sensor. The engine control unit uses this information for fuel injection timing and cylinder identification.
CMP Sensor - Analog
This is an inductive pickup type sensor. It is used to detect rotational speed and position of the camshaft by interpreting a reluctor wheel attached to the camshaft. It produces an analog voltage output based on the reluctor wheel; this can be observed at the sensor. The engine control unit uses this information for fuel injection timing and cylinder identification.
Tech note:
A sensor that is improperly installed/indexed can identify the wrong cylinder as 1, may produce a tip-in hesitation and may generate DTC P0340.
Some vehicles equipped with variable camshaft timing will use two CMP sensors one for each bank.

Figure 4-6 *Component Information screen*

Screens are divided into up to four sections to help quickly guide you to the correct information:

- **Operation—**provides a general description of normal component operation.
- **Tech note**—provides component related tips (for example, common failures or faults) as well as information on factory updates and recalls.
- **Connector—**displays the component connector and lists pin assignments.
- **Location**—identifies the component location and the best place for testing it.

3. Use the scroll bar along the right edge of the screen to view any additional information.
4. Select **Back** on the Toolbar, or press the **N/X** button, to return to the component menu.

Tests

The Tests section guides you through the process of performing tests on a specific component. Selecting a component test gives you access to specifications, tips on how and where to connect the Diagnostic Tool leads, and configures a meter to perform the specific test.

To select a test:

1. Select a component from the list.
2. Select a test from the component menu.

   The component menu lists all of the tests available for the selected component, choices vary by the type of component as well as the make, model, and year of the vehicle.

   Selecting opens an additional menu similar to the one shown in Figure 4-7 when multiple choices are available.

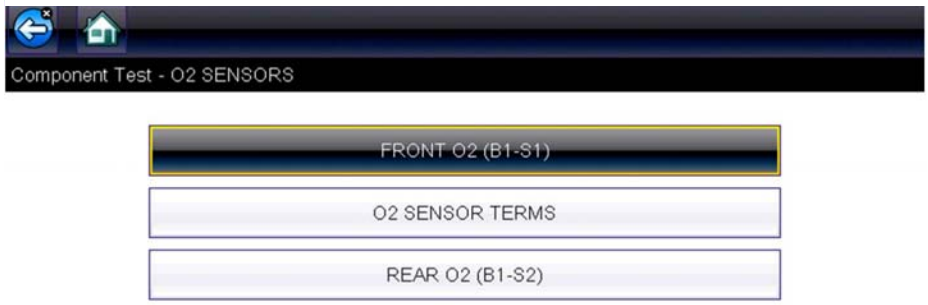


Figure 4-7

NOTE:
There may be several levels of submenus for certain components. Select from the menus as needed to get to the test screen.

3. Select an option from the Guided Component Tests list and the test screen displays (Figure 4-8).

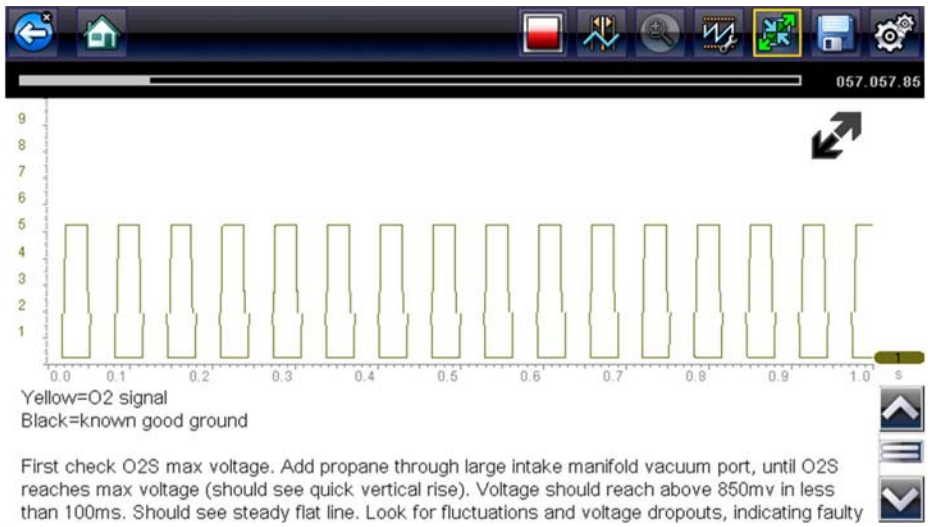

057.057.85
Yellow=O2 signal
Black=known good ground
First check O2S max voltage. Add propane through large intake manifold vacuum port, until O2S reaches max voltage (should see quick vertical rise). Voltage should reach above 850mv in less than 100ms. Should see steady flat line. Look for fluctuations and voltage dropouts, indicating faulty

Figure 4-8 *Test screen*

A Guided Component Test initially opens with the information panel below the main body of the screen visible. Typically, connection information is on the screen and a scroll indicator displays along the right edge if there is additional information below what is shown.

4. Select the **Expand/Collapse** icon on the toolbar to view the Diagnostic Tool only.
5. Select **Back** on the toolbar to return to the menu.

Profile Controls

The preconfigured meter is used for conducting most of the component tests. However, if the need to capture a specific signal trace is needed, adjustment of the trace signal settings can be made by selecting the **Profile** icon from the toolbar.

For more detained information about adjusting how a sampled signal displays on the screen refer to Profile Control Icons, on page 30.

4.2.4 Saving and Reviewing Data Files

Save and Stop control icon operation and data review procedures are the same as used for the Scope/Multimeter function, see Saving and Reviewing Scope / Multimeter Data Files, on page 38.

Chapter 5 Scope Multimeter

Scope Multimeter enables your diagnostic Diagnostic Tool to function as a digital multimeter (DMM), graphing multimeter (GMM), or 2-channel oscilloscope.

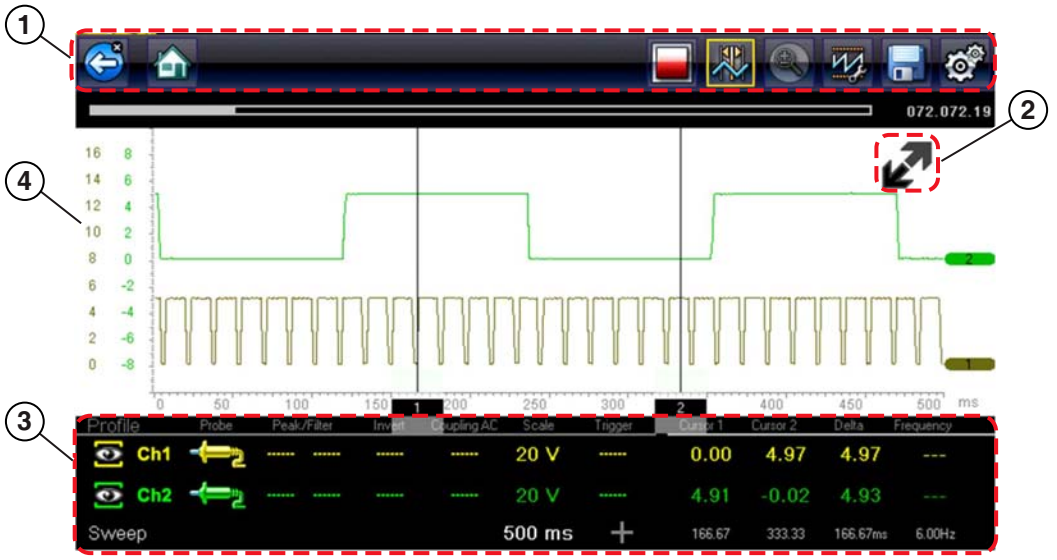
5.1 Screen Layout and Toolbar Icons

This section describes general navigation of the Scope Multimeter function.

Scope Multimeter tests are general and not vehicle specific. Vehicle identification is not required, meter setting adjustments are usually needed and supporting information is not available.

NOTE:
The following description of terms are provided for reference, as used in this manual:
Trace - The actual line displayed on the scope screen.
Waveform - The graphic representation of a signal over time, which the trace displays on the scope screen.

5.1.1 Screen Layout



1— Toolbar—contains control icons

2— Expand/Collapse icon—toggles Main body view between split and full graph/meter profile views

3— Profile Controls Window—displays profile control icons and trace display settings

4— Main Body—displays test graph/meter

Figure 5-1 *Test screen*

Main Body

The main body of the Scope Multimeter test screen may display the following:

- Menu - Select from a menu using the touch screen or the control buttons.
- Diagnostic Tool - Diagnostic Tools can display two circuit traces, or waveforms, simultaneously. Adjustments to the display are made through the toolbar. Each trace is displayed as voltage over time on a standard oscilloscope screen. Voltage level is recorded on the vertical, or “y”, axis and time is presented on the horizontal, or “x”, axis of the screen. Values are shown for each graduation on the scales

Touch screen functionality within the main body of the screen is limited, most adjustments are performed from the Toolbar and the Profile Controls window. However, you can adjust the following in the main body:

- Trigger position; touch and drag the trigger indicator (+) to reposition it.
- The baseline position (0 value) of the trace can be repositioned on the horizontal scale by touching and dragging the solid bar at the right-end of the channel baseline.

5.1.2 Scope Multimeter Control Icons

Scope Multimeter toolbar control icons may vary depending on the active function or test. A yellow frame surrounding an icon (highlighted), indicates it is selected. Other control icons (not shown) are described in Common Toolbar Control Icons, on page 12.

Table 5-1

Icon	Function
	Stop - Stops the collection of data
	Cursors - Toggles cursor display on/off. Cursors are two vertical rules that can be repositioned on the screen to measure intervals.
	Zoom - Increases and decreases screen magnification.
	Profile - Displays the profile settings at the bottom of the screen allowing adjustment of the trace signal display settings.

5.2 General Information

5.2.1 Lab Scope Information

The following describes the capabilities and specifications of the Lab Scope.

- 2 Channel Lab Scope
- Volts DC
- Low Amps (20)
- Low Amps (40)
- Low Amps (60)
- Ignition Probe
- 100 PSI Vacuum
- 100 PSI Pressure
- 500 PSI Pressure
- 5000 PSI Pressure
- MT5030 Vacuum
- MT5030 Pressure
- EEDM506D Temperature

Table 5-2

Function	Range	Accuracy/Comments
Signal Measurement	Ch. 1—banana jack, yellow Ch. 2—banana jack, green	Each channel input is referenced to common ground (GND—black banana jack)
Sample Rate	For 50uS sweep 6MSPS For 100uS sweep 3MSPS For all other sweeps 1.5 MSPS	Continuous sampling, MSPS = mega samples per second
Band Width	3 MHz	3 db point @ 3 MHz
Input Impedance	10 Mohm @ DC 4 kohm @ 3 MHz	Channel 1 and 2
VDC (Full Scale)	100mV–400V	Do not measure greater than 75VDC
VAC (Full Scale)	100mV–400V	Do not measure greater than 50 VAC (rms)
Low Amp Probe	20A scale (100mV/Amp) 40A scale (10mV/Amp) 60A scale (10mV/Amp)	Connect the positive (+) Amp Probe lead to the yellow jack on the diagnostic Diagnostic Tool for values on Ch.1, or to the green jack on the Diagnostic Tool for values on Ch. 2. Connect the negative (–) lead to GND (black jack)**1**.
1. Do not use the Low Amp Probe to measure current on conductors at a potential greater than 46VAC peak or 70VDC.		

5.2.2 Graphing Multimeter Information

The following describes the capabilities and specifications of the Graphing Multimeter.

- Dual Graphing Meter
- Volts DC
- Volts DC - Average
- Volts AC RMS
- Ohms
- Frequency
- Pulse Width
- Injector Pulse Width
- Duty Cycle
- Low Amps (20)
- Low Amps (40)
- Low Amps (60)
- MC Dwell (60)
- MC Dwell (90)
- 100 PSI Vacuum
- 100 PSI Pressure
- 500 PSI Pressure
- 5000 PSI Pressure
- MT5030 Vacuum
- MT5030 Pressure
- EEDM506D Temperature

Table 5-3

Function	Range	Accuracy/Comments
Signal Measurement	Ch. 1—banana jack, yellow Ch. 2—banana jack, green	Each channel input is referenced to common ground (GND—black banana jack)
Sample Rate	1.5 MSPS	Continuous sampling, MSPS = mega samples per second
Band Width	3 MHz	3 db point @ 3 MHz
Input Impedance	10 Mohm @ DC 4 kohm @ 3 MHz	Channel 1 and 2
VDC (Full Scale)	75VDC	Do not measure greater than 75VDC
VAC (Full Scale)	50VAC	Do not measure greater than 50 VAC (rms)
Ohm Measurement Diode Test Continuity Test	Ch. 1— banana jack, yellow (–) Ch. 2— banana jack, green (+)	
Ohms	40 Ohm—4 Mohm	Fixed scales
Low Amp Probe	20A scale (100mV/Amp) 40A scale (10mV/Amp) 60A scale (10mV/Amp)	Connect the positive (+) Amp Probe lead to the yellow jack on the diagnostic Diagnostic Tool for values on Ch.1, or to the green jack on the Diagnostic Tool for values on Ch. 2. Connect the negative (–) lead to GND (black jack)[1].
1. Do not use the Low Amp Probe to measure current on conductors at a potential greater than 46VAC peak or 70VDC.		

5.2.3 Digital Multimeter Information

The following describes the capabilities and specifications of the Digital Multimeter.

- Volts DC
- Volts DC - Average
- Volts AC RMS
- Ohms
- Diode/Continuity
- Low Amps (20)
- Low Amps (40)
- Low Amps (60)

Table 5-4

Function	Range	Accuracy/Comments
Signal Measurement	Ch. 1—banana jack, yellow	Input is referenced to common ground (GND—black banana jack)
VDC (Full Scale)	75VDC	Do not measure greater than 75VDC
VAC (Full Scale)	50VAC	Do not measure greater than 50VAC (rms)
Signal Measurement Input Impedance	10 Mohm	
Ohm Measurement Diode Test Continuity Test	Ch. 1— banana jack, yellow (–) Ch. 2— banana jack, green (+)	
Ohms	40 Ohm—4 Mohm	Fixed scales or auto ranging
Glitch Capture	Approximately 50 uS	
Diode test	2V scale	

5.2.4 Measurement Out of Range

A group of arrows display when a measurement is out of range for the scale selected:

- Arrows pointing UP—measurement over maximum range
- Arrows pointing DOWN—measurement under minimum range

Voltage measurements also display arrows in place of live values when the voltage exceeds the input rating of the meter.

⚠ WARNING

Risk of electrical shock.

- **Do not exceed voltage limits between inputs as indicated on the rating label.**
- **Use extreme caution when working with circuits that have greater than 40 volts AC or 24 volts DC.**

Electrical shock can cause personal injury, equipment damage, or circuit damage.

IMPORTANT:
If arrows are displayed in the live voltage values, discontinue circuit testing.

Correct an out-of-range condition by selecting a scale setting appropriate for the signal being sampled. See Scale, on page 34 for more information.

5.3 Leads, Adapters and Probes

The Scope Multimeter uses standard safety plugs that are compatible with many accessories. The leads, clips, and adapters supplied with or available for the Diagnostic Tool are explained in this section.

IMPORTANT:
When removing leads from their sockets, do not pull on the wire because it can damage the leads. Pull on the plug.

5.3.1 Channel 1 Lead

The shielded yellow lead is used for Channel 1 (Figure 5-2). The lead color matches the color of socket 1 on the Diagnostic Tool and the color of trace 1 on the test screens.

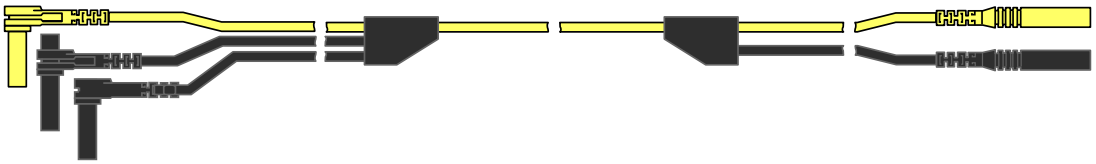


Figure 5-2 *Yellow Channel 1 Lead*

This yellow lead includes a black, right-angle, common ground plug and a black, stackable, common ground plug. The non-stackable ground plug always connects to the ground (GND) jack on top of the Diagnostic Tool. The stackable ground plug is used for connecting additional leads, such as the Channel 2 Lead or the Secondary Coil Adapter Lead, that require grounding. The stackable lead grounds through the non-stackable lead and does not need to be connected to the jack on the Diagnostic Tool.

5.3.2 Channel 2 Lead

The shielded green lead (Figure 5-3) is used for Channel 2. The lead color matches the color of socket 2 on the Diagnostic Tool and the color of trace 2 on the test screens. This green lead includes a stackable, black, right-angle ground plug.

Figure 5-3 *Green Channel 2 lead*

5.3.3 Alligator Clips

Insulated alligator clips that attach to the test leads are included. The alligator clips are color coded to match each test lead. Alligator clips attach to the probe end of the test lead (Figure 5-4).

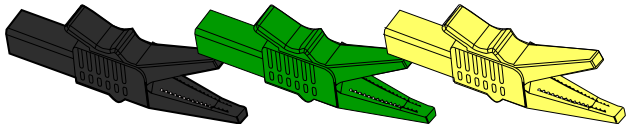


Figure 5-4 *Alligator clips*

5.3.4 Secondary Coil Adapter Lead (optional)

The optional Secondary Coil Adapter lead (Figure 5-5) connects to the clip-on secondary wire adapter, coil-in-cap adapter or coil-on-plug adapter to display secondary waveforms.

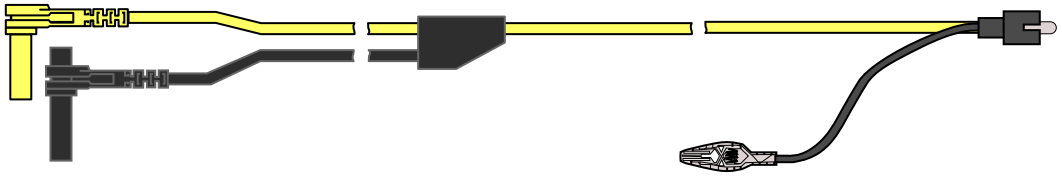


Figure 5-5 *Secondary Coil Adapter lead*

5.3.5 Secondary Ignition Clip-on Wire Adapter (optional)

The optional Secondary Ignition Clip-on Wire Adapter (Figure 5-6) connects the Secondary Coil Adapter lead to the vehicle secondary wire to display ignition patterns.

Figure 5-6 *Secondary Ignition Clip-on Wire Adapter*

5.3.6 Low Amp Current Probe (optional)

The optional Low Amp Current Probe (Figure 5-7) provides accurate and reliable non-intrusive testing of ignition coils, fuel injectors, fuel pumps, relays, electric motors, and parasitic draw. Use the Low Amp Current Probe to measure current from 10 mA to 60 Amps with a resolution of 1 mA.

Figure 5-7 *Low Amp Current Probe*

5.4 Scope Multimeter Operation

This section describes configuring the scope or meter and performing tests.

5.4.1 Starting Scope Multimeter

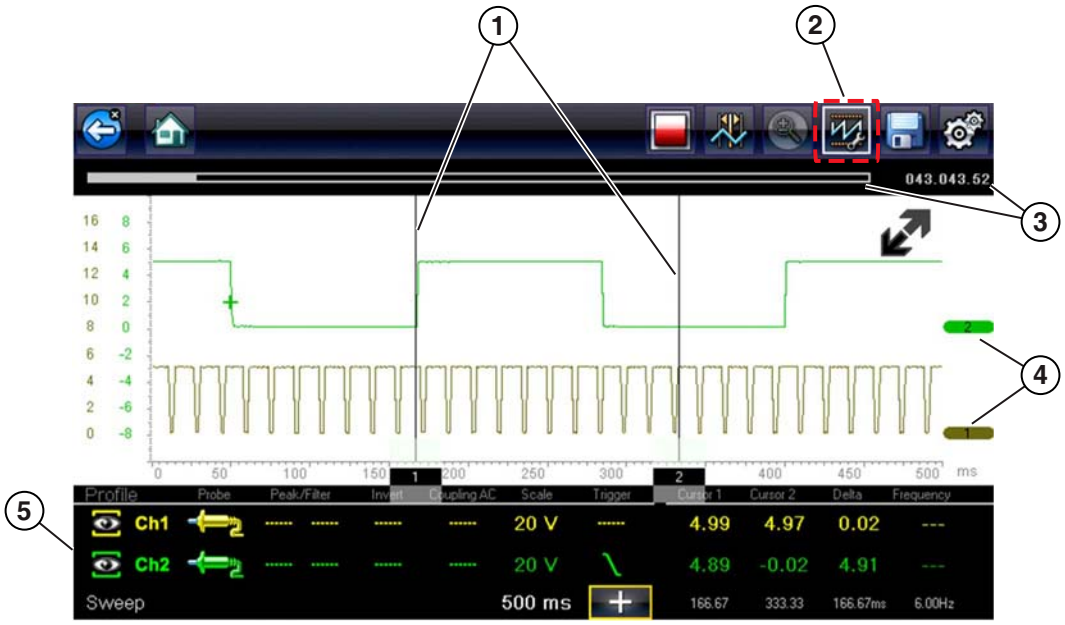
To start the scope multimeter:

1. Select the **Scope Multimeter** icon from the Home screen.
2. Select a menu option: **Lab Scope**, **Graphing Multimeter** or **Digital Multimeter**
3. Select a test type submenu option.
   The Scope Multimeter displays for the selected test.

5.4.2 Scope Multimeter Setup

The following sections explain how to adjust the scope and multimeter for the specific type of signal being sampled. A preconfigured meter, which reduces setup time, is available for many applications in Component Test, see Power User Tests, on page 16 for details.

Most of the setup operations are available by selecting the **Profile** icon on the toolbar. Selecting the icon opens the Profile Controls window at the bottom of the screen and highlights (yellow frame appears) the icon. Selecting the icon again changes the highlight to a white frame (Figure 5-8) and allows manual navigation (using directional control buttons) of the Profile Control icons in the Profile Controls window.



1— Cursors—vertical rules used to measure intervals
2— Profile Icon—opens Profile Controls Window
3— Position Indicator—graphical and numerical position indicators
4— Channel Indicators—displays active channel number
5— Profile Controls Window—displays profile control icons and trace display settings

Figure 5-8

Profile Control Icons

The Profile control icons are located in the Profile Controls window and used to adjust individual characteristics of how the signal is sampled and displayed on each channel. Available options include:

- Show/Hide—switches the channel display on/off.
- Trace—adjusts trace baseline position.
- Probe—allows selection of test probe to be used and displays current probe.
- Peak—maximizes the signal sampling rate for capturing fast events, such as voltage spikes, dropouts, and glitches.
- Filter—removes noise or interference from the waveform.
- Invert—switches the polarity of the displayed signal.
- Coupling AC—blocks the DC portion of an input signal in order to amplify the AC portion.
- Scale—adjusts the scale, which is the total value of the vertical axis of the display.
- Trigger—switches triggering on or off, and sets which slope of the waveform triggers.
- Refresh—clears the digital minimum and maximum values and updates the screen.
- Sweep—adjusts the sweep, which is the total value of the horizontal axis of the display.

Show/Hide

The show/hide icons are used to toggle the displayed signal channel off/on.

Show/Hide	Icon	Description
On		Channel displayed
Off		Channel not displayed

Select the icon or press **Y/✓** to toggle the channel off/ on.

Trace

The trace setup icons are used to adjust the baseline position (0 value) of the displayed trace

Icon	Description
	Opens trace baseline setup adjustment

Select the icon or press **Y/✓** to display the trace scale adjustment control.Select the up/down arrows to make adjustments or press the up/down directional buttons. Press the **N/X** button, to exit. The trace baseline can also be repositioned by touching and dragging the solid bar at the right-end of the channel baseline marker on the screen.

Probe

The Probe icon is used to select the type of device being used to sample the signal. Options are:

- Test Lead - Volts DC
- Vacuum 100
- Pressure 100
- Pressure 500
- Pressure 5000
- Low Amps 20
- Low Amps 40
- Low Amps 60
- Ignition
- EEDM506D Temperature
- MT5030 Vacuum
- MT5030 Pressure
- Close

To select a probe:

1. Select the **Probe** icon for the desired channel.
   The Probe selection menu opens (Figure 5-9).

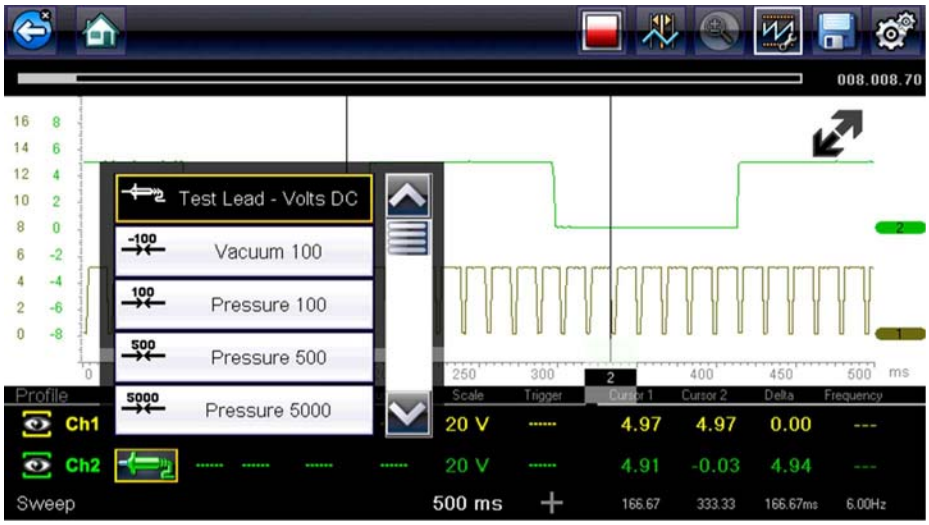


Figure 5-9 *Probe selection menu*

2. Highlight the desired probe in the menu.
3. Touch the highlighted probe to select it.
4. Select **Close**, the last entry on the list of probes, to close the menu window.

Peak

The peak icons are used to switch peak detect on and off.

Peak	Icon	Description
On		Peak detect is active for the designated channel.
Off		Peak detect is inactive for the designated channel.

With peak detect off; the scope collects just enough data to plot a waveform across the screen. This is the standard mode of operation for many scopes. With peak detect on; the scope samples at the maximum rate possible and captures more sample points than needed to plot the screen. These additional sample points permit fast events and glitches to be included in the waveform.

For example: with a sweep setting of 10 seconds on a screen 100 points wide, the sample rate would be 10 times a second. Decreasing the sweep to 1 second, increases the sample rate to 100 times a second. Now, a fast occurring event is likely to be captured due to the increased rate.

Peak detect puts the scope in a high speed sampling mode, which under certain circumstances may result in unwanted noise from components such as injectors and solenoids being picked up and displayed. Therefore, there are time when peak detect should not be used because the waveform may be distorted or hard to read due to noise.

An example of when not to use peak detect would be when sampling an oxygen (O2) sensor signal. An O2 sensor signal is relatively slow and requires, a clean, noise-free pattern for an accurate diagnosis. If peak detect is on, more noise is picked up making diagnosis difficult.

Filter

The filter icons are used to switch filtering, which removes noise and other interference from the waveform, on and off.

Filter	Icon	Description
On		Unwanted interference has been removed from the waveform displayed for the designated channel.
Off		Any signal interference on the sampled circuit is included in the waveform displayed for the designated channel.

The filter works slightly different depending upon what type of the test is being conducted:

- For a direct measurement test, such as volts, amps, or pressure, the filter minimizes the display of very fast spikes by averaging the sampled data when filter is active.
- For a calculated measurement test, such as frequency, pulse width, dwell, or duty cycle, extremely fast spikes (20 uS and faster) from sources like the ignition system are ignored when filter is active.

Filter smooths out spikes and fast variations in the waveform, which provides a good balance between noise suppression and signal integrity. The Filter setting is most useful when working with scales of 5 volts and below. The lower the volts scale, the more likely noise could be an issue.

An example of when to use Filter would be for testing an O2 sensor using a 1 or 2 volt scale, or performing a throttle position (TP) sensor sweep test using a 5 volt scale.

Filter is also beneficial for low amp probe testing. Due to the conversion factors used by the probe, a very low volts scale is used to measure the output of the probe. For a probe with a conversion factor of 100 mV/A connected to a 2 amp load, the scope uses a 200 mV scale to measure the output of the probe. The scope converts the measured output to 2 amps for display on the screen.

Invert

The Invert setting is used to switch the polarity of the waveform on the screen. For example; invert the signal of square waveform that rises from 0 volt to 5 volts and the display would show a waveform that falls from 0 volt to –5 volts.

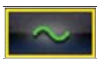
An icon displays when the waveform on the screen has been inverted:

Invert	Icon	Description
On		The polarity of the waveform being displayed is inverted for the designated channel.
Off		The waveform is being displayed normally for the designated channel.

Coupling AC

Coupling AC subtracts the average value of a signal so that small variations display on the waveform. This is done by blocking the direct current (DC) portions of a signal in order to amplify the alternating current (AC) portions of the signal without driving the waveform off of the screen.

An icon displays when Coupling AC is active:

Coupling AC	Icon	Description
On		The DC portion of the waveform is blocked to amplify the AC portion, which displays for the designated channel.
Off		The DC portion of the waveform NOT blocked for the designated channel.

This option is ideal for viewing items such as alternator ripple or fuel pump amperage.

Scale

The Scale setting adjusts the vertical, or y axis, value of what displays on the screen. The value shown in the Profile information panel represents the entire height of the display area for that channel. Scales can be set independently for each channel.

To adjust the scale:

1. Select **Profile** from the Scope Multimeter toolbar.
   The Profile information window opens.
2. Select the **Scale** value for the channel you wish to adjust.
   The Scale menu opens (Figure 5-10).

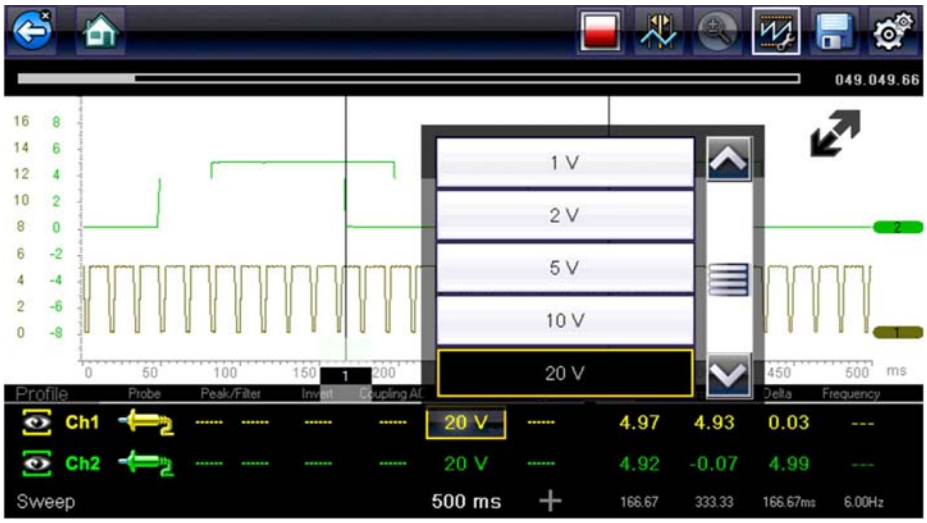


Figure 5-10 *Scale menu*

3. Highlight the desired scale in the menu.

4. Touch the highlighted scale to select it.
5. Select **Close**, the last entry on the list of scales, to close the menu window.

Trigger

Trigger setup allows you to set the Scope Multimeter so that it begins displaying a waveform once predetermined signal conditions, or triggers, are met. Triggering produces a much more stable waveform. The waveform always begins at the trigger point, so the image does not appear to flicker or drift as it updates. When working with a 2-channel setup, a trigger can only be set for one of the channels.

The trigger point is indicated by a plus sign (+) on the scope grid. The plus sign can be dragged across the screen to roughly position it. Use the Trigger Controls, available by selecting the large plus (+) sign at the base of the screen, to accurately adjust the trigger position. You can choose which slope of the waveform to trigger on using the Profile controls.

To set a trigger:

1. Select **Profile** from the Scope Multimeter toolbar.

   The Profile information window opens.
2. Select the **Trigger** icon for the channel you want the trigger set to.

   Each tap of the icon moves you progressively through the three states of triggering; rising, falling, and off.

   Tapping the icon moves you sequentially through the three available setting.

Trigger	Icon	Description
Rising		The waveform for the designated channel begins as voltage rises to the threshold value, shown as a plus sign (+) in the main body of the screen.
Falling		The waveform for the designated channel begins as voltage drops to the threshold value, shown as a plus sign (+) in the main body of the screen.
Off		There is no trigger set for the designated channel.

3. Once the slope is determined, select the plus sign (**+**) at the bottom of the information window. The trigger adjustment controls open (Figure 5-11).

Figure 5-11 *Trigger controls*

4. Select the arrowheads on the screen, or use the keypad to move the trigger into position. A digital readout centered between the arrowheads gives the precise position of the trigger.
5. Select **Profile** from the toolbar, or press the **N/X** button, to exit.

Refresh

Selecting **Refresh** from the Profile Controls window clears the minimum and maximum digital values for both waveforms and updates the viewing screen. These digital values, which display to the right of the Refresh icon, are the highest and lowest value recorded for each waveform since the test was activated, or from the last time Refresh was selected.

Sweep

Sweep is the amount of time represented by the screen, or the horizontal scale of the display. Setting sweep adjusts the x axis of the display screen. Sweep can be adjusted in increments ranging from 5 nanoseconds to 20 seconds. The value on the bottom line of the Profile information panel indicates the sweep setting for both channels. Sweep applies to the entire meter and cannot be set independently for the two channels.

To adjust the sweep:

1. Select **Profile** from the Scope Multimeter toolbar.
   The Profile information window opens.
2. Select the **Sweep** value on the bottom line of the Profile Controls window.
   The Sweep menu opens (Figure 5-12).

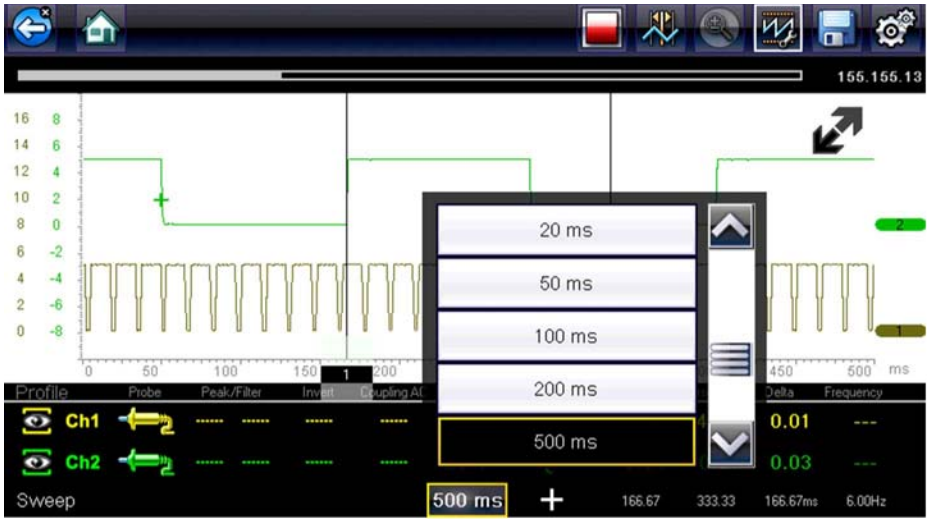


Figure 5-12 *Sweep menu*

3. Scroll to highlight the desired sweep value in the menu.
4. Select the sweep control.
5. Select **Close**, the last entry on the list, to close the menu window.

Cursors

Selecting the **Cursor** icon on the toolbar displays two vertical rules on the screen that can be repositioned to measure intervals (Figure 5-13).Select the **Cursor** icon again to cancel the cursors.

Figure 5-13 *Cursor display*

To reposition the cursors:

1. Select the **Cursor** icon on the toolbar to display the cursors.
2. Touch (cursor base) and drag into the desired position.
3. Repeat step 2 for other cursor.

5.4.3 Saving and Reviewing Scope / Multimeter Data Files

The following procedures are used when saving and reviewing data files for Scope/Multimeter and Guided Component Tests.

Saving Files

During normal scope multimeter operation, waveforms are continuously being stored in buffer memory as they are being displayed onscreen. Buffer memory is limited to a predetermined “total” size and is displayed on the counter (located below the toolbar on the right side of the screen) (Figure 5-15).

Selecting **Save** writes the stored buffer memory to a file. Saving files is useful when trying to isolate an intermittent problem or to verify a repair during a road test. The saved file can be played back (similar to a movie clip) by selecting **Previous Vehicles and Data > View Saved Data**. See View Saved Data, on page 44 for additional information.

NOTE:
The **Save icon** performs the same function as “Save Movie” function choice for the programmable **Shortcut** button, see Configure Shortcut Button, on page 47 for details.

The saved file can also be downloaded to a personal computer (PC) using the Mini USB jack. Once connected to the PC, the files can be printed, transferred, and copied using ShopStream Connect. ShopStream Connect is an application that creates an interface between the Diagnostic Tool and a PC. The ShopStream Connect application is available free online, see the ShopStream Connect website information at the front of this manual for additional information.

The toolbar control icons are described in Scope Multimeter Control Icons, on page 23 and Common Toolbar Control Icons, on page 12.

To save files:

- Select **Save**.

  A save dialog box displays while files are being saved. The file is saved when the message box disappears.

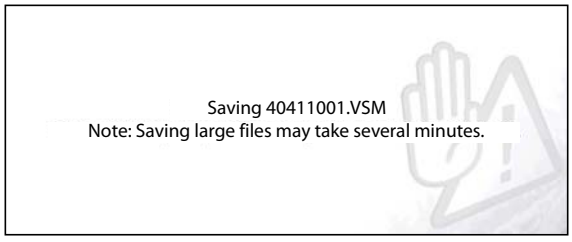


Figure 5-14 *Save dialog box*

Saving Screens

The **Shortcut** button can be programmed to save a snapshot of a visible screen as a bitmap file, see Configure Shortcut Button, on page 47 for details The saved file can be viewed by selecting **Previous Vehicles and Data > View Saved Data**, see View Saved Data, on page 44 for additional information.

Stopping and Reviewing Data Files

During normal scope multimeter operation, waveforms are continuously being store stored in buffer memory as it is displayed onscreen. The Stop feature, allows you to temporarily stop the signal trace to review it in detail.

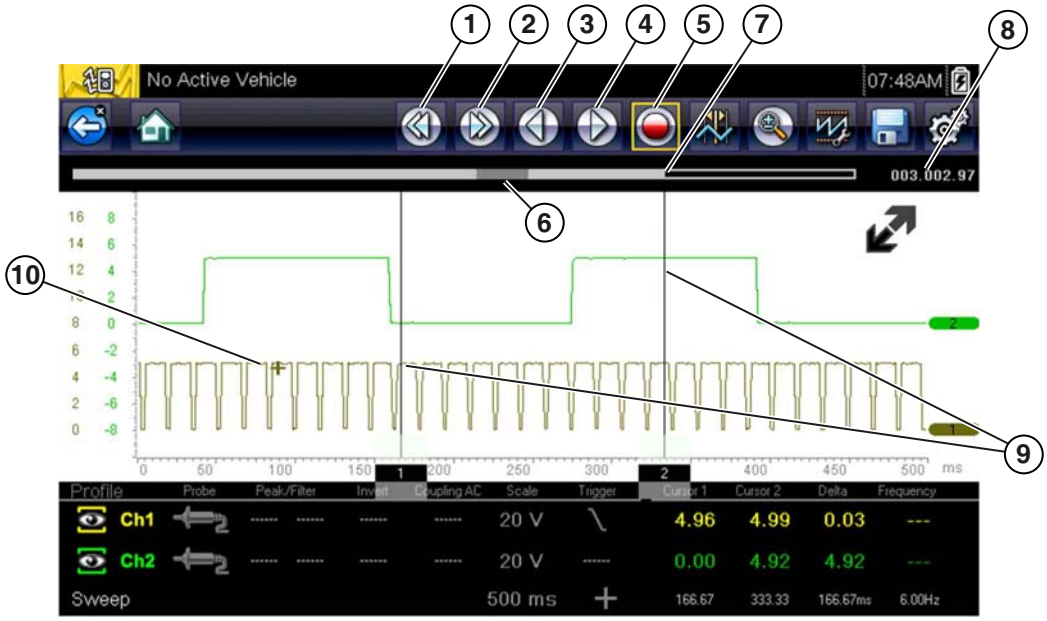
To stop and review data files

Playback control icons are described in Scope Multimeter Control Icons, on page 23 and Common Toolbar Control Icons, on page 12.

1. While viewing signal trace(s), select the **Stop** icon.

   On the toolbar, the playback control icons are displayed. A counter displays along the right-hand edge of the screen between the toolbar and the main body. A bar graph to the left of the counter shows how much captured information is in the memory buffer. A slider on the bar graph indicates the position of the current screen in relation to the entire contents of the memory buffer.

   Use the slider to quickly scroll through the waveform (Figure 5-15).



1— Skip Back
2— Skip Forward
3— Step Back
4— Step Forward
5— Record
6— Slider
7— Bar Graph
8— Counter (current position)
9— Cursors
10—Trigger Point

Figure 5-15

2. Select the desired control icon to move forward or back in the selected direction.

To resume:

- Select the **Record** icon.

  The display changes back and the **Stop** icon is shown on the toolbar.

NOTE:
The **Shortcut** button can be set to perform the Pause/Play function. See Configure Shortcut Button, on page 47 for additional information.

5.4.4 Using the Zoom Function

The zoom function allows you to change the magnification level of the waveform sweep during review. Changing magnification levels allows you to compress or expand multiple screens of data to quickly find glitches, or signal losses.

Example: While monitoring data during an engine MAF (Mass Air Flow Sensor) test, the waveform displays normally. As the engine continues to run, an erratic “condition” suddenly develops, but is not noticed in the waveform. Stopping the data capture when the “condition” is noticed allows you review the waveform in greater detail (higher zoom level) to look for a glitch in the waveform to see if the MAF could be at fault.

During “live” data capture, the default magnification level is 1x. The zoom function is not available until data capture is stopped by pressing the **Stop** icon (Figure 5-17).

1— Stop Control Icon

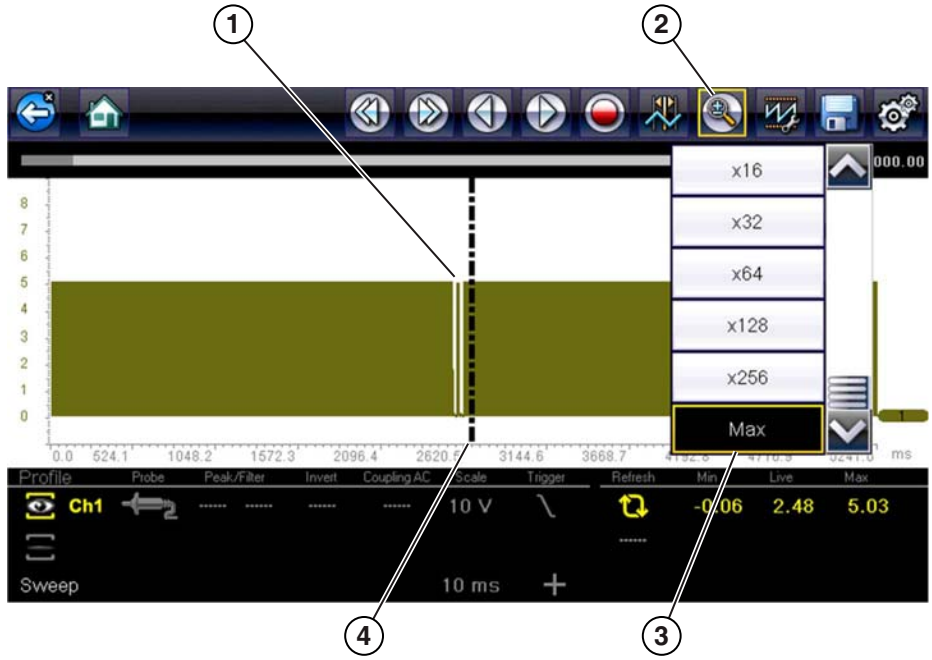
Figure 5-16 *Typical “Live" Data (waveform)*

NOTE:
Zoom playback controls are identical to the standard playback controls used when reviewing data files, with the following exception:

Skip Forward / Skip Back control icons - (press once) moves multiple steps relative to set magnification level (e.g. 2X setting, moves 2 steps; 16X setting, moves 16 steps)

Additional information on playback control icons are described in Scope Multimeter Control Icons, on page 23 and Common Toolbar Control Icons, on page 12.

When the **Zoom** icon is selected the display defaults to the "Max" magnification level and a dropdown scroll menu displays. The dropdown menu allows you to select the display magnification level from a range of 1X to 256X. The "Max" (maximum) option displays all data captured on one screen (Figure 5-17).



1— Waveform Glitches
2— Zoom Icon
3— Zoom Magnification Level (Max shown)
4— Zoom Cursor

Figure 5-17 *"Max" Magnification Level - displays all captured data*

When zoom levels of 2X and higher are selected, a Zoom cursor (vertical dashed line) (Figure 5-17) displays onscreen. The cursor is used to quickly mark and navigate to points of interest or glitch in a captured waveform.

The Zoom cursor can be used to mark the approximate position of a glitch and can be manually dragged onscreen to the desired position. The new cursor position will be centered on the screen when a lower magnification level is selected. Figure 5-18 shows examples at 32X and 64X with the Zoom cursor positioned in the area of a signal drop glitch.

NOTE:
To quickly identify a glitch such as signal drop in a pattern, it may be easier to initially view the waveform at a higher magnification level (e.g. 256X or "Max") to display the entire captured waveform, then lower the zoom level to 8X or 2X to review in detail.

1— Waveform Glitches

2— Magnification Level at 128X

3— Magnification Level at 32X

Figure 5-18 *Examples of Magnification Level at 32X and 128X*

Figure 5-19 shows an example at 16X of the same waveform shown in Figure 5-17 and Figure 5-18. In Figure 5-19, this example at 16X the glitches are easily seen as compared to higher magnification levels.

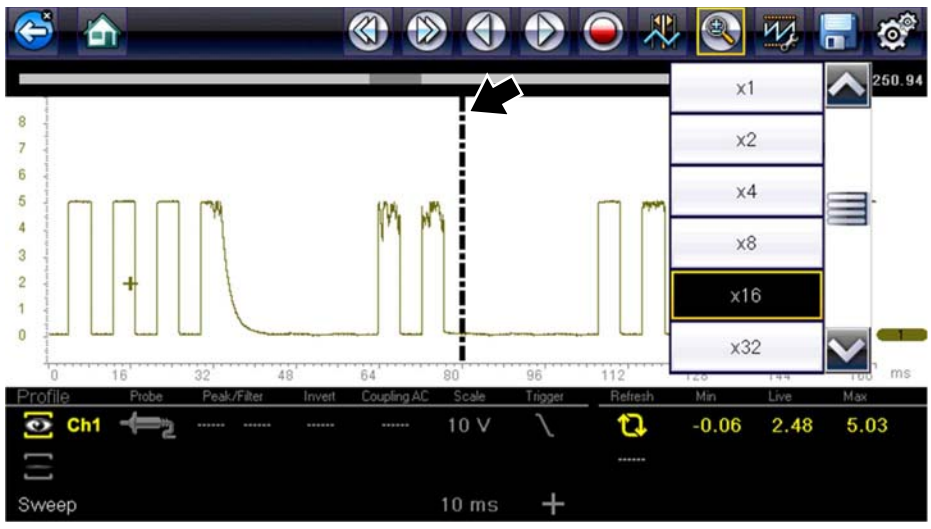


Figure 5-19 *Example of Magnification Level at 16X. (For illustration purposes, the Zoom cursor has been positioned in the area of the glitches.)*

Chapter 6 Previous Vehicles and Data

This chapter describes the basic operation of the Previous Vehicles and Data function.

The **Previous Vehicles and Data** icon is located on the Home screen. This function allows you to select recently tested vehicles and access saved data files.

6.1 Previous Vehicles and Data Menu

The following options are available from the Previous Vehicles and Data menu:

- Vehicle History
- View Saved Data, on page 44
- Delete Saved Data, on page 45

6.1.1 Vehicle History

The Diagnostic Tool stores the identification of the last twenty-five vehicles tested, so there is no need to go through the complete vehicle identification sequence when performing a retest after repairs have been made. The oldest vehicle record is deleted when a new vehicle is identified once there are twenty-five vehicles on file.

Vehicle History
2007 LAND ROVER RANGE ROVER
4.2L V8 MPI Supercharged = 428PS
OBD
2000 FORD FOCUS 1.4L DOHC = P
2009 PEUGEOT 407 1.6L 16V T-DIESEL = 9HZ
2007 BMW X5 (E53)
3.0L TURBO DIESEL = 306D2

Figure 6-1 *Vehicle history list*

To select from the vehicle History:

1. Select **Previous Vehicles and Data** from the Home screen.
2. Select **Vehicle History** from the menu.

   A list of up to 25 previously tested vehicles displays. Each vehicle is given a unique file name. Scroll to view the entire list.
3. With the item to be opened highlighted, either select the vehicle ID or press the **Y/✓** button.

   The appropriate software loads and a vehicle ID confirmation screen displays.
4. Select **OK** or press the **Y/✓** button to continue.

   The System Menu for the selected vehicle displays.

6.1.2 View Saved Data

Selecting the **View Saved Data** menu option opens a list of all the saved data (movie) files and screen images that are stored in memory. Saved files are listed in chronological order by the date and time that they were created with the most recent files are at the top of the list.

Figure 6-2 *Saved data list*

Saved files can either be opened directly on the Diagnostic Tool, or downloaded to a personal computer and opened using ShopStream Connect. See Stopping and Reviewing Data Files, on page 39 and Connect-to-PC, on page 47 for additional information.

NOTE:
A maximum of 50 files are displayed. To view all (if more than 50) files stored, use ShopStream Connect. See Connect-to-PC, on page 47 for additional information.

To review a saved data file or image:

1. Select **Previous Vehicles and Data** from the Home screen.
2. Select **View Saved Data** from the menu.
3. Select a file to review from the list.

6.1.3 Delete Saved Data

This menu option is used to permanently erase saved files from memory.

To delete a saved file:

1. Select **Previous Vehicles and Data** from the Home screen.
2. Select **Delete Saved Data** from the menu.

   A list of saved files displays.

NOTE:
The Select All/Deselect All and Delete icons become available on the toolbar so that you can either delete individual files or clear the entire memory buffer all at once.

3. Select a file from the list and a confirmation message displays.
4. Select an option from the confirmation message:
   - **OK**—deletes the selected file and returns to the saved files list, which no longer includes the deleted file.
   - **Cancel**—returns to the saved files list without deleting the selected file.
5. Select **Back** on the toolbar to return to the Previous Vehicles and Data menu, select **Home** to return to the Home screen.

Chapter 7 Tools

This chapter describes the basic operation of the Tools function.

The **Tools** icon is located on the Home screen. This function allows you to configure Diagnostic Tool settings to your preferences.

7.1 Tools Menu

The following options are available from the Tools menu:

- Connect-to-PC—use to transfer and share files with a personal computer (PC)
- Configure Shortcut Button, on page 47—use to change the function of the shortcut button
- System Information, on page 48—use to view configuration information for the Diagnostic Tool
- Settings, on page 48—use to configure certain characteristics of the Diagnostic Tool

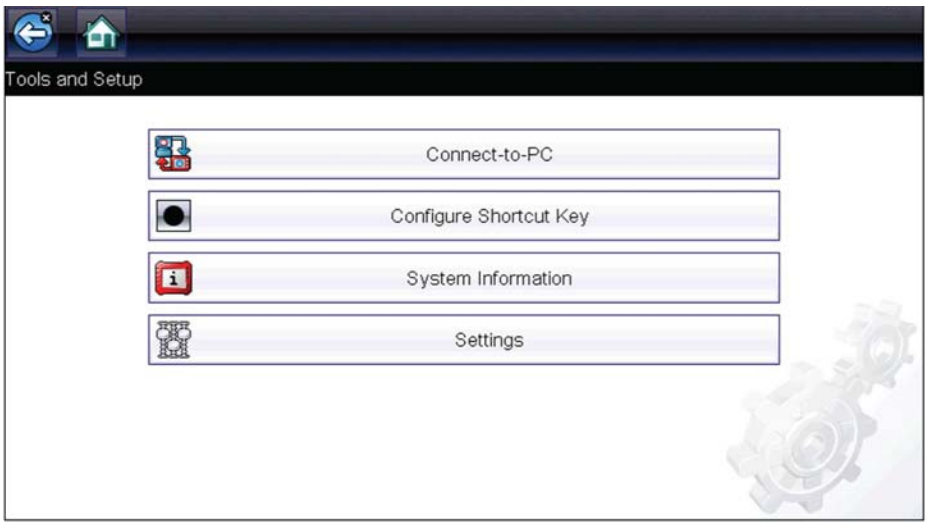


Figure 7-1 *Tools menu*

7.1.1 Connect-to-PC

Connect-to-PC allows you to transfer saved data files on your Diagnostic Tool to your personal computer using a USB cable.

The optional ShopStream Connect™ PC software allows you to view, print and save data files on your PC. In addition, you can download software updates from the PC to the Diagnostic Tool. These features provide an ideal way to manage saved data files. The ShopStream Connect application is available free online, see the ShopStream Connect website information at the front of this manual for additional information.

To connect the Diagnostic Tool to a PC:

1. Select **Tools** from the Home screen to open the menu.
2. Select **Connect-to-PC** from the Tools and Setup menu.

   A screen message displays stating that the Diagnostic Tool can be connected to a PC as a mass storage device.
3. Connect the supplied USB cable to the Diagnostic Tool and then to the PC.
4. Select **Continue**.
5. Follow the instructions on the screen to complete the operation.

A USB cable, supplied with your Diagnostic Tool, is used to connect the Diagnostic Tool to the PC.

7.1.2 Configure Shortcut Button

This feature allows you to change the function of the **Shortcut** button. Options are:

- **Brightness**—opens the brightness setting screen.
- **Save Screen**—saves a bitmap image of the visible screen.
- **Save Movie**—writes data from buffer memory to a file for future playback.
- **Show Shortcut Menu**—opens the menu so you can quickly select from any of the functions.
- **Toggle Record/Pause**—programs the Shortcut button to work as the Pause and Play icons.

To assign a function to the Shortcut button:

1. Select **Tools** from the Home screen.

   The Tools menu opens.
2. Select **Configure Shortcut button** from the menu.
3. Select a function from the menu.
4. Select the **Back** on the toolbar or press the **N/X** button to return to the options menu.

7.1.3 System Information

System Information allows you to view patent information and system information such as the software version and serial number of your Diagnostic Tool.

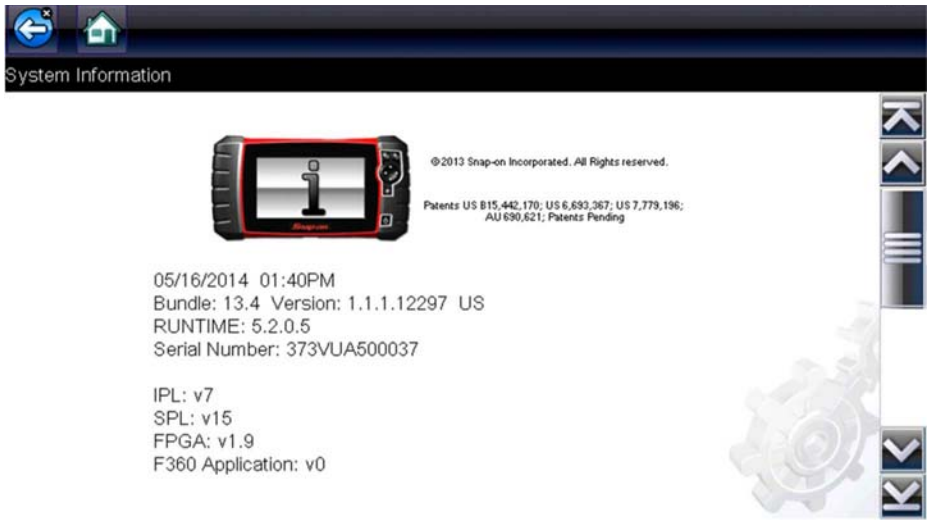


Figure 7-2 *System information*

To display the System information screen:

1. Select **Tools** from the Home screen to open the menu.
2. Select **System Information** from the menu.
   The System Information screen displays.
3. Scroll as needed to view all of the data.
4. Select **Back** on the toolbar or press the **N/X** button to return to the options menu.

7.1.4 Settings

This Tools selection allows you to adjust certain basic Diagnostic Tool functions to your personal preferences. Selecting opens an additional menu that offers the following:

- System Settings - see System Settings, on page 49
- Configure Units - see Configure Units, on page 57

System Settings

Selecting System Settings opens a menu with two options; Display and Date & Time. Either selection opens an additional menu.

Display options include:

- Brightness, on page 49—adjusts the intensity of the screen back lighting.
- Color Theme, on page 50—changes the background color of the screen display.
- High Contrast Toolbar, on page 50—enhances toolbar graphics for poor lighting conditions.
- Font Type, on page 51—switches between standard and bold text for better visibility.
- Backlight Time, on page 51—adjusts how long the screen stays on with an idle Diagnostic Tool.
- Touch Screen Calibration, on page 52—calibrates the touch screen display.

Date & Time options include:

- Time Zone, on page 52—sets the internal clock to the local time standard.
- Clock Settings, on page 53—sets the time on the internal clock.
- Daylight Savings Time, on page 53—configures the clock for Daylight Savings Time.
- Time Format, on page 54—switches the time displays between a 12 or 24 hour clock.
- Date Format, on page 54—configures how the month, date, and year displays.

Brightness

Selecting this option opens the brightness setting screen for adjusting the back lighting of the display (Figure 7-3).

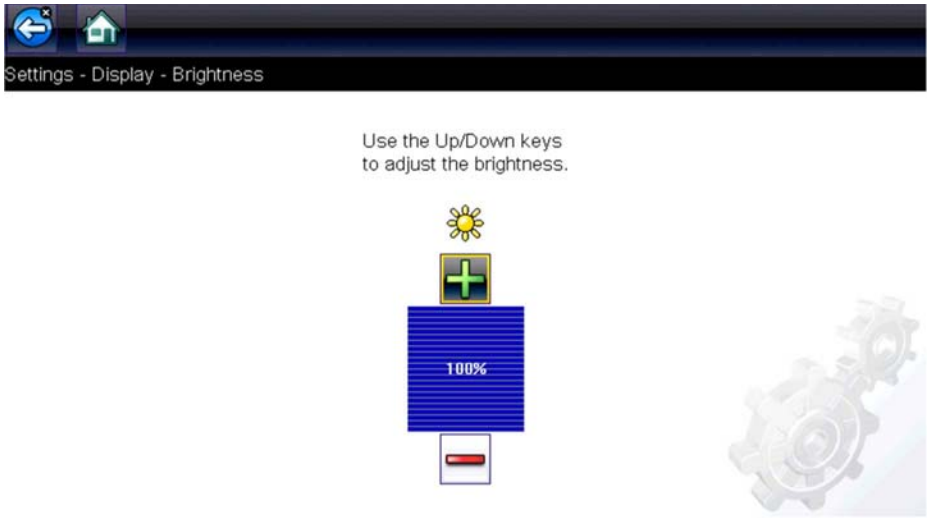


Figure 7-3 *Brightness setting*

Each push of the **Plus** and **Minus** icons, or the up (▲) and down (▼) arrows, incrementally changes the back lighting up or down respectively.

Select **Back** from the toolbar or press the **N/X** button to exit.

Color Theme

This option allows you to select between a white and black background for the screen. The black background can be beneficial when working under poor lighting conditions.

Selecting opens a menu with two choices: **Day Theme** (white background) and **Night Theme** (black background). Make a selection and a “please wait” message momentarily displays followed by the Home screen. The new toolbar setting is now active.

High Contrast Toolbar

This option allows you to switch to a high contrast toolbar. This toolbar features black and white icons with crisp graphics that are easier to see in poor lighting conditions or bright sunlight.

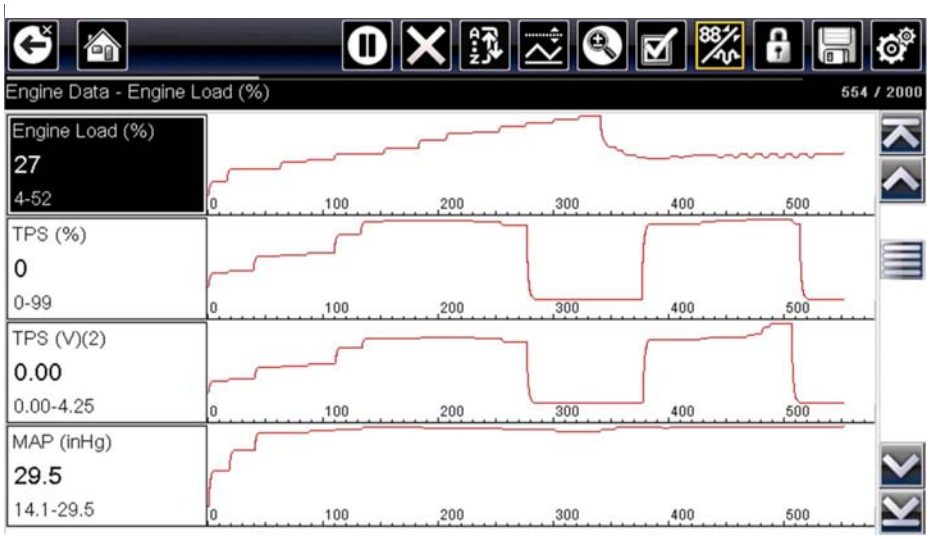


Figure 7-4 *High-contrast toolbar*

Selecting opens a menu with two choices; Color Toolbar and High Contrast Toolbar. Select and a “please wait” message displays followed by the Home screen. The new setting is now active.

Font Type

This option allows you to select between standard and bold faced type for the display screen. Bold type makes screen writing more legible under poor lighting or bright sunlight conditions.

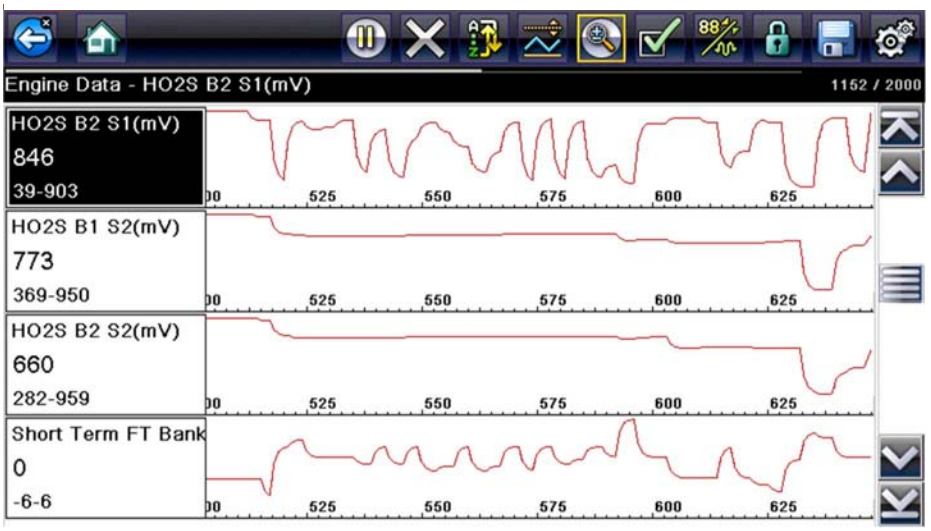


Figure 7-5 *Bold Font*

Selecting opens a menu with two choices: Normal Font and Bold Font. Select a menu item or scroll and then press the **Y/✓** button to make a selection. The change is instantaneous. Select the Back or Home icon on the toolbar to return to either the Settings menu or the Home screen.

Backlight Time

This option allows you to configure how long the screen backlight remains on when the Diagnostic Tool is inactive. The following choices are available:

- Always On
- 15 Seconds
- 30 Seconds
- 45 Seconds
- 60 Seconds

Select the menu item desired, or scroll and then press the **Y/✓** button to make a selection. Select **Back** or **Home** on the toolbar to return to either the Settings menu or the Home screen.

Touch Screen Calibration

Calibrating the touch screen maintains the accuracy of the touch-sensitive display.

IMPORTANT:
To avoid serious damage to the Diagnostic Tool, always complete the touch screen calibration sequence once it has begun. **Never turn off the Diagnostic Tool while a screen calibration is in process.**

To calibrate the touch screen:

1. Select **Tools** from the Home screen to open the menu.
2. Select **Settings** from the menu.
3. Select **Touch Calibration** from the menu.
   The calibration screen opens (Figure 7-6).

TOUCH SCREEN CALIBRATION
WARNING: Do not power the tool off until the Touch Calibration has been completed successfully.
TOUCH BOX IN UPPER LEFT CORNER

Figure 7-6 *Touch screen calibration*

4. Select each box on the screen as it displays.
   The display returns to the Settings menu once the screen calibration procedure is complete.

Time Zone

This option opens a menu of time zone settings. Scroll to highlight, then select the local time zone. The display returns to the Settings menu once a time zone is selected.

Clock Settings

This option opens a window for resetting the time on the real-time clock.

To set the clock:

1. Select **Tools** from the Home screen to open the menu.
2. Select **Settings** from the menu.
3. Select **Clock Settings** from the menu.
   A warning message briefly displays followed by the Clock Settings screen (Figure 7-7).

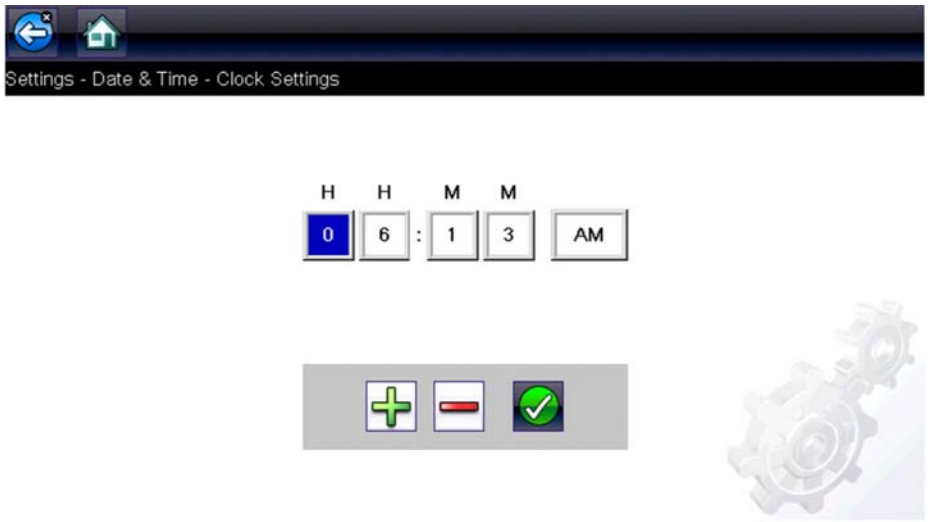


Figure 7-7 *Clock settings*

4. Select the **up** (**+**) icon on the screen or press the **up** (▲) button to incrementally increase the number in the highlighted field. Select the **down** (**–**) icon on the screen or press the down (▼) button to incrementally decrease the number.
5. Select the **check** (✓) icon on the screen or press the **Y/**✓ button to move the highlight to the next field.
6. Repeat Step 4 and Step 5 until the correct time is displayed.
7. Select the **Back** icon on the toolbar or press the **N/X** button to close the Clock Settings window and return to the Settings menu.

Daylight Savings Time

This option opens a menu to configure the internal clock for Daylight Savings Time. Choose from:

- **ON**—sets the clock for Daylight Savings time.
- **OFF**—sets the clock for standard time.

Make either selection, then select the **Back** icon or press the **N/X** button to return to the menu.

Time Format

This option determines whether time is displayed on a 12 or 24 hour clock. Selecting opens a menu with two choices:

- **24 Hour Format**
- **12 Hour Format**

Make either selection, then select the **Back** icon or press the **N/X** button to return to the menu.

Date Format

This option allows you to select how date information is displayed. Select from:

- **(MM_DD_YYYY)**—Month, Day, Year
- **(DD_MM_YYYY)**—Day, Month, Year
- **(YYYY_MM_DD)**—Year, Month, Day

Make a selection, then select the **Back** icon or press the **N/X** button to return to the menu.

Configure Scope/Meter

This option allows you to configure how customize certain characteristics of the display screen when using the Scope Multimeter module. Selecting opens a menu with the following options:

- Trigger Mode, on page 54
- Display, on page 55
- Divisions, on page 56

Trigger Mode

Configure Scope/Meter allows you to choose the type of trigger to begin an automatic recording, see Trigger, on page 35 for additional information. Two triggering choices are available:

- **Auto Trigger**—sets the meter to automatically trigger once the signal reaches a set value.
- **Manual Trigger**—sets the meter so that you provide the trigger input with a button push.

Select a menu item, then select **Back** or press the **N/X** button to return to the Configure Scope/Meter menu.

Display

This option switches a grid pattern on the meter screen on and off.

Figure 7-8 *Scope multimeter screen grid*

To switch the Display:

1. Select **Tools** from the Home screen.
2. Select **Settings** from the Tools and Setup menu.
3. Select **Configure Scope/Meter** from the Settings menu.
4. Select **Display** from the menu.
5. Highlight either menu entry to make a selection:
   - **Show Grid**—to switch the grid lines on.
   - **Hide Grid**—to switch the grid lines off.
6. Select the **Back** icon or press the **N/X** button to return to the Settings menu.

Divisions

The option allows you to switch between Full Scale or Per Division settings for the trace setup and the display settings. Full Scale configures the meter so one division, or unit, is the full viewing area of the screen. Per Division adjusts a single unit, or division, to one tenth of the screen.

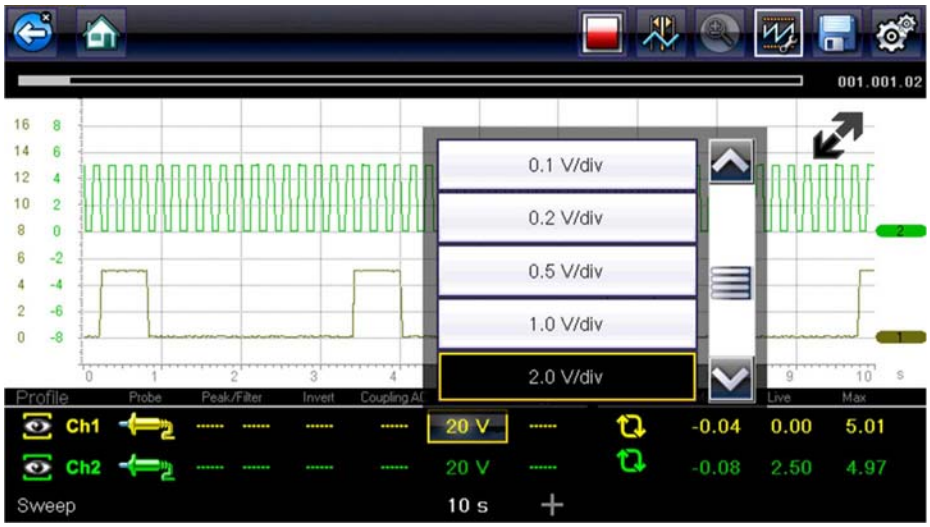


Figure 7-9 *Scope Multimeter screen set to Per Division*

To switch the divisions:

1. Select **Tools** from the Home screen.
2. Select **Settings** from the Tools and Setup menu.
3. Select **Configure Scope/Meter** from the Settings menu.
4. Select **Divisions** from the menu:
   a. Highlight either menu entry to make a selection:
   - **Trace Settings**—to adjust the screen width divisions.
   - **Display Settings**—to adjust the screen height divisions.

   b. Select from the menu:
   - **Full Scale**—one unit per screen.
   - **Per Division**—ten units per screen.

   c. Select the **Back** icon or press the **N/X** button twice to return to the menu.
   d. Select **Trace Settings** or **Display Settings**, and repeat Step 4 if needed.
5. Select the **Back** icon or press the **N/X** button to return to the Settings menu.

Configure Units

Selecting opens a dialog box that allows you to choose between US customary or metric units of measure for temperature, vehicle speed, air pressure, and other pressures.

Figure 7-10 *Configure units menu*

To change the units setup:

1. Select **Tools** from the Home screen to open the menu.
2. Select **Configure Units** to open the menu.
3. Select an item from the Configure Units menu.
4. Select a setting from the listed choices.
5. Select **Back** on the toolbar or press the **N/X** button to return to the options menu.

Chapter 8 Maintenance

This chapter describes basic cleaning and battery replacement procedures for your Diagnostic Tool.

8.1 Cleaning and Inspecting the Diagnostic Tool

Periodically perform the following tasks to keep your Diagnostic Tool in proper working order:

- Check the housing, cables and connectors for dirt and damage before and after each use.
- At the end of each work day, wipe the Diagnostic Tool housing, cables and connectors clean with a damp cloth.

IMPORTANT:
Do not use any abrasive cleansers or automotive chemicals on the Diagnostic Tool.

8.1.1 Cleaning the Touch Screen

The touch screen can be cleaned with a soft cloth and a mild window cleaner.

IMPORTANT:
Do not use any abrasive cleansers or automotive chemicals on the touch screen.

8.2 Battery Pack Service

Follow all safety guidelines when handling the battery pack.

⚠ WARNING

Risk of electric shock.

- **Prior to recycling the battery pack, protect exposed terminals with heavy insulating tape to prevent shorting.**
- **Disconnect all test leads and turn Diagnostic Tools off before removing the battery pack.**
- **Do not attempt to disassemble the battery pack or remove any component projecting from or protecting the battery terminals.**
- **Do not expose the Diagnostic Tool or battery pack to rain, snow, or wet conditions.**
- **Do not short circuit the battery terminals.**

Electric shock can cause injury.

⚠ WARNING

Risk of explosion.

- **Use the proper factory battery pack only, incorrect replacement or tampering with the battery pack may cause an explosion.**

Explosion can cause death or serious injury.

8.2.1 Battery Pack Safety Guidelines

IMPORTANT:
The battery pack contains no user serviceable components. Tampering with the battery pack terminals or housing will void the product warranty.

Keep the following in mind when using and handling the battery pack:

- Do not short circuit battery terminals.
- Do not immerse the Diagnostic Tool or battery pack in water, or allow water to enter the Diagnostic Tool or battery compartment.
- Do not crush, disassemble, or tamper with the battery pack.
- Do not heat the battery pack to over 100°C (212°F), or dispose of it in a fire.
- Do not expose the battery pack to excessive physical shock or vibration.
- Keep the battery pack out of reach of children.
- Do not use a battery pack that appears to have suffered abuse or damage.
- Store the battery pack in a cool, dry, well ventilated area.

NOTE:
The battery pack should be used within a short period of time (about 30 days) after charging to prevent loss of capacity due to self-discharging.

If long-term storage of the battery pack is necessary, it should be stored in a in cool, dry, well ventilated place with a 30 to 75 percent state of charge to prevent loss of characteristics.

To prolong the life of your battery, turn off the Diagnostic Tool when not in use. The Diagnostic Tool has a built in charger that recharges the battery on demand whenever it is connected to a power source.

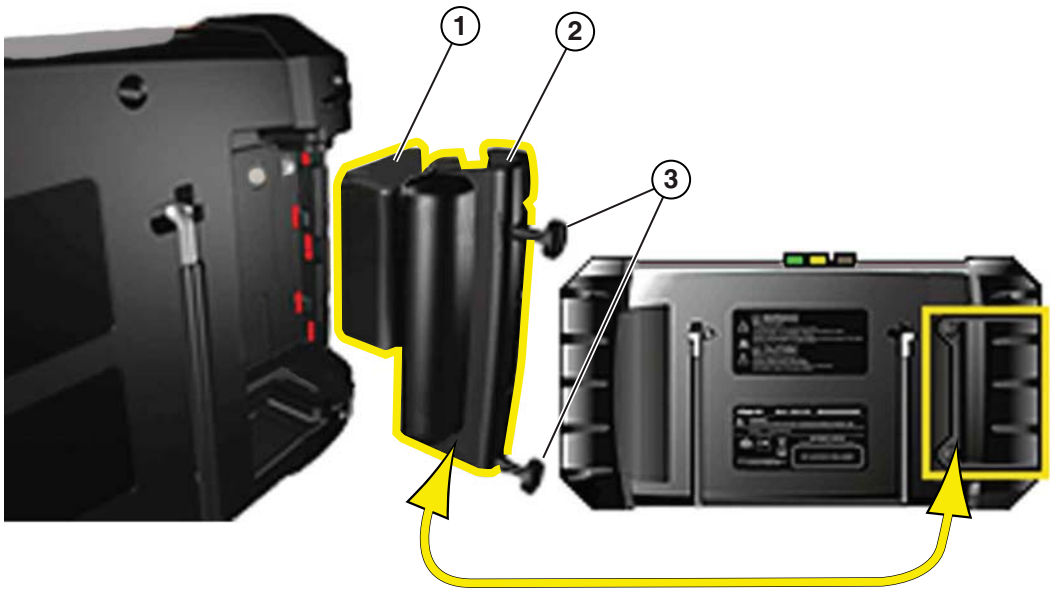
8.2.2 Replacing the Battery Pack

If the battery pack no longer holds a charge, contact your sales representative to order a new one.

IMPORTANT:
Replace the battery pack with original Snap-on replacement parts only.

To replace the battery pack:

1. Loosen the two captive screws that retain the battery compartment cover on the back-side of the Diagnostic Tool.
2. Pull up on the inner edge of the battery compartment cover to release it, pivot the cover into an upright position, then lift the battery cover off of the housing.
3. Slide the battery down to disengage the electrical contacts.
4. Remove the battery from the tool housing.
5. Align the tabs on the sides of the battery compartment with the slots on the new battery, then place the battery into the housing.
6. Slide the battery up to engage the electrical contacts and snap it into place.
7. Fit the battery cover onto on the housing, then pivot the cover down so that it snaps into place.
8. Snug up the captive screws to hold the cover in place. ***Do not overtighten the screws!***



1— Battery
2— Battery Cover
3— Battery Cover Screws

Figure 8-1 *Battery pack replacement*

8.2.3 Disposing of the Battery Pack

Always dispose of the battery pack according to local regulations, which vary for different countries and regions. The battery pack, while non-hazardous waste, does contain recyclable materials. If shipping is required, ship the battery pack to a recycling facility in accordance with local, national, and international regulations. For additional information contact:

- North America—Rechargeable Battery Recycling Corporation (RBRC) at http://www.rbrc.org or http://www.call2recycle.org, or call 1(800) 822-8837 (USA)
- United Kingdom—Electrical Waste Recycling Company at http://www.electricalwaste.com

Products bearing the WEEE logo (Figure 8-2) are subject to European Union regulations.

Figure 8-2 *WEEE logo*

NOTE:
Always dispose of materials according to local regulations.

Contact your sales representative for details.

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